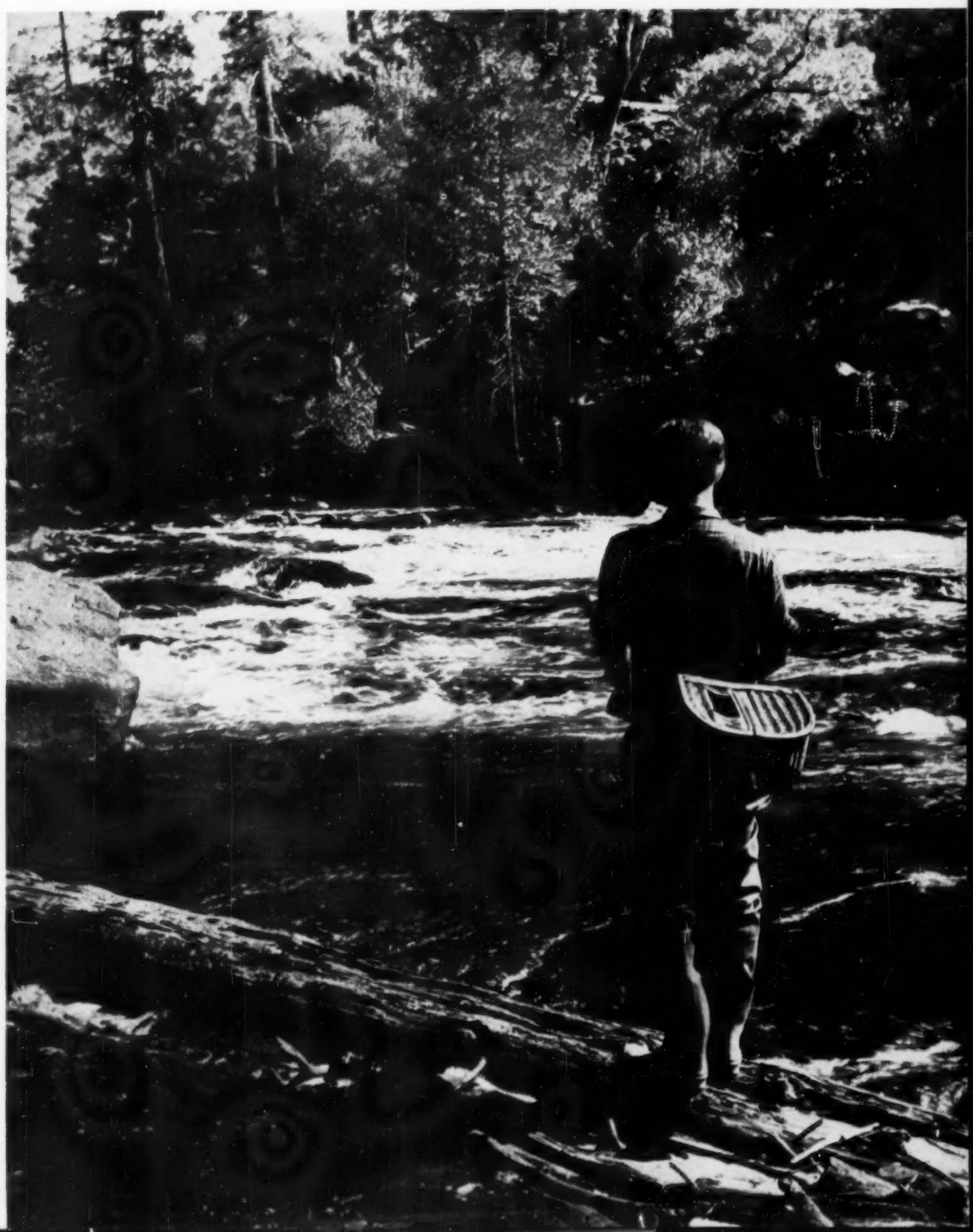
Journal of FORESTRY

JULY 1955



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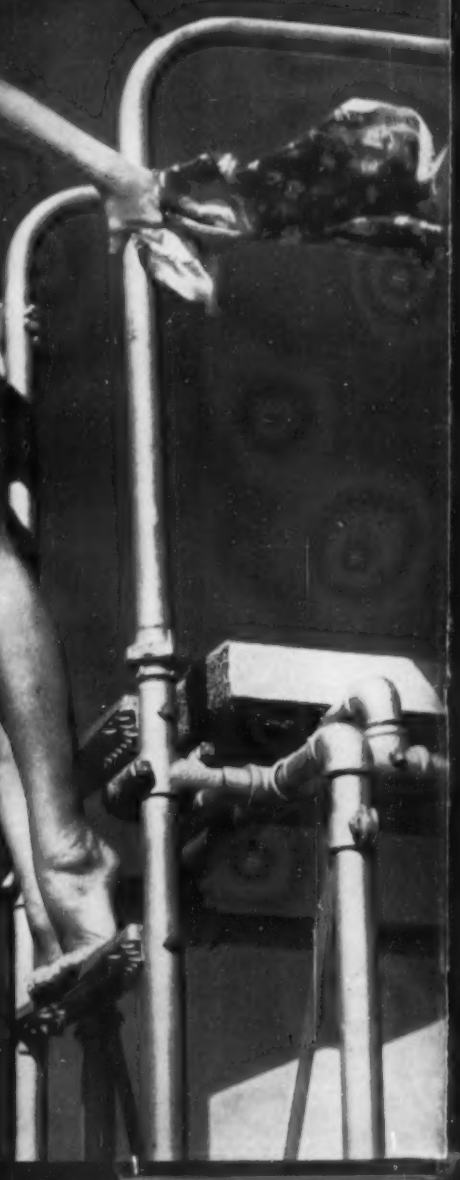

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Photo courtesy U. S. Forest Service

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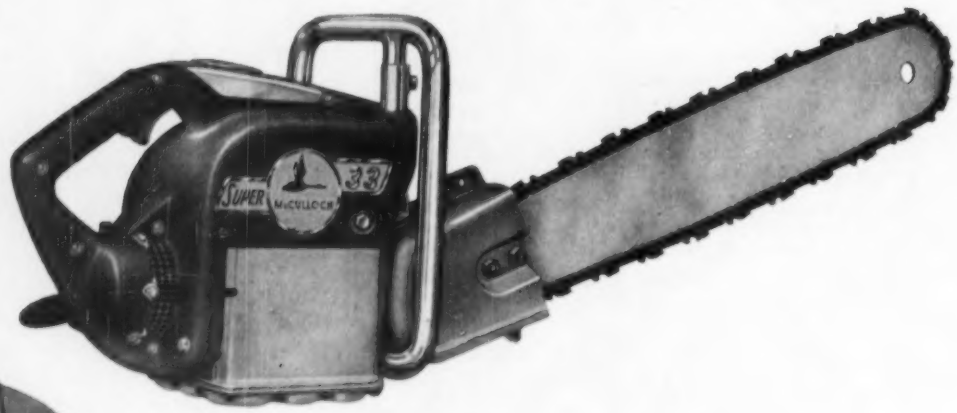

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Airplanes Increase Effectiveness of Southern Pine Beetle Surveys

R. C. Heller, J. F. Coyne and J. L. Bean[1]

Division of Forest Insect Research, Forest Service, U. S. Department of Agriculture

ALL SOUTHERN PINE forests, especially those containing loblolly and shortleaf pines, are susceptible to destructive outbreaks of the southern pine beetle (*Dendroctonus frontalis* Zimm.). Several outbreaks are known to have occurred during the past 60 years and to have caused tremendous timber losses. During recent years, beginning in 1945, outbreaks have been recorded with increasing frequency in the region. During 1950 and 1951 approximately 80 million board feet of saw timber and pulpwood were killed in an outbreak in Texas. Fortunately, through the adoption of prompt salvage programs the majority of the dead timber in these two states was saved for utilization, but at a greatly reduced stumpage value. In 1954, outbreaks were recorded in Mississippi, Alabama, Tennessee, and North Carolina.

The southern pine beetle is a very prolific insect. In the southern part of its range it may produce from four to six generations a year, with a possible tenfold increase per generation. Thus, given a favorable set of circumstances, infestations are literally explosive in nature. New attacks by this insect usually start in single trees or in small groups of trees. These infestation spots (Fig. 1) are widely scattered and develop more or less simultaneously when conditions favorable for brood development occur. They expand in size as individuals in succeeding generations attack nearby trees. Such centers of killed trees may cover 100 or more acres. Because of population pressures, exhaustion of forest type, or other causes, adult beetles fly outward from these centers. Some of these start new centers of infestation, thereby enlarging and intensifying outbreaks.

FIG. 1.—Scattered southern pine beetle infestation as indicated by arrows. Brackets indicate area where beetle infested trees were removed. Super xx film, A 25 (red) filter.

Outbreaks are controlled primarily by salvage of infested trees before broods emerge or by felling the trees and treating them with insecticide spray (*2*). However, before a control operation can be adequately planned, pine stands in the general area must be surveyed to determine the extent and intensity of the outbreak.

Conventional ground survey methods are too slow and expensive for use in surveying aggressive epidemics of the southern pine beetle. New infestation centers commonly break out on an average of every six weeks. To keep track of them by ground surveys would often require the services of many men, working continuously. On

[1]Respectively, Beltsville Forest Insect Laboratory, Beltsville, Maryland; Southern Experiment Station, Gulfport, Mississippi, and Northeastern Forest Experiment Station, Upper Darby, Pennsylvania.

FIG. 2.—Cessna 195 airplane used on insect damage surveys. Note particularly cut-down side doors to permit maximum observer visibility.

the other hand, because trees killed by the southern pine beetle change color progressively from green to yellow, thence to orange, red and brown, it seemed possible that airplane observers could conduct these surveys at a greatly reduced cost. In actual practice this has been found to be the case; aerial observers are able to easily detect discolored foliage of infested pine trees for distances of 2 miles at altitudes of 3,000 to 5,000 feet from the ground. The contrast between green and fading trees is even sharper when viewed from above than from the ground. The only problem is to locate infested spots from the air with sufficient accuracy to enable ground crews to find them with a minimum of scouting.

An aerial survey method which was first tried in Texas in 1950, and later proved successful during the Mississippi outbreak in 1952-53, is described in this paper. Essentially, this method consists of the plotting by aerial observers of infested spots directly on existing aerial photographs. The marked photographs are then used by control crews in locating the infested spots on the ground.

Four-place high-wing monoplanes (Fig. 2) have been found best suited for aerial observation and are recommended for use in surveying the southern pine beetle. Two aerial observers experienced in recognizing typical southern pine beetle damage occupy seats on opposite sides of the airplane. (Two observers double the effective coverage and reduce flight time by almost one-half.)

Several possible methods for use in surveying southern pine beetle outbreaks from the air were explored in the search for an effective and economical one. The method that was finally selected is outlined, step by step, below. It has been used successfully in surveying large forested areas for evidence of infestation during the past couple of years.

1. Make a reconnaissance flight to determine the extent of the outbreak. One way to do this effectively is to fly in cardinal directions from a known infested spot and mark the extremities of the heavily infested areas on small scale planimetric maps (e.g., 1 inch = 4 miles).

2. Obtain aerial photographs (scale 1:20,000 approximately) and index mosaics of the entire outbreak area. If it is necessary to purchase the photos, alternate ones only need be obtained, since the photos are not used stereoscopically. (A map entitled the *Status of Aerial Photography in the U. S.*, and a supplement describing from whom these photographs may be purchased is available from the Map Information Office, U. S. Geological Survey, Washington 25, D. C.)

3. Draw survey flight lines on each index mosaic at the edge of the first column of photographs and thence on every odd column (Fig. 3—Columns 1, 3, 5, etc.) until the mosaic is completely covered.

4. Assemble the individual photos into columns similar to those on the mosaic. For each column, staple the photos into strip approximately 36 inches long, matching similar landmarks as closely as possible. Attach the strips to ¼-inch plywood boards, 20x36 inches. Place the southernmost strip on the left side of the board and the next strip on the right side, oriented in the same direction. The sequence of photos will then be from bottom to top of the left strip, and from bottom to top of the right strip. Prepare two photo filled boards for each flight line, one for each side of the airplane. Fill the reverse sides of these boards with photos of adjacent flight lines. Each observer carries 4 to 5 boards permitting coverage of 8 to 10 flight lines during one aerial trip.

5. Fly the airplane along flight lines drawn on the index mosaic (pilot uses index mosaic as a map) at 70-80 miles per hour at 3,000-5,000 feet above the ground, depending upon cloud conditions.

6. When airborne, two observers orient their map boards with flight direction, and tracking begins in the lower left corner. Discolored trees or groups of trees are plotted on the photographs with red china-marking pencil, care being taken to plot the size and shape of the infestation and to tie it in as accurately as possible with nearby landmarks. Where a high density of infestations occur each flight line is reflown. This is done for two reasons: (1) to permit observers to plot infestations missed on the first flight, and (2) to locate infestations which might occur in the blind strip under the plane. In reflights, the plane should be flown about ½ mile to one side of the original flight line.

Observers should wear amber face shields or goggles (equal to G filter). These increase the contrast between green trees and discolored trees. They also increase visibility on hazy days; thereby permitting more efficient detection of infestations.

7. The aerial phase of the survey may be expedited by using one additional man on the ground to assemble photos and boards for subsequent flights, and to reassemble marked photos onto a large master board (4- x 8-foot plywood

sheet). Setting up of this master board eliminates any duplication of aerial plotting which might occur where the photos of adjacent flight strips overlap. He then superimposes a dot template (1) over the marked infestations, and estimates the discolored acreage to the nearest half acre. The total number of infestations and their acreages are tabulated for each county. Finally, a small scale master map of all counties is prepared to show the locations and frequency of infestation for the entire outbreak.

On a very active outbreak, three to five aerial surveys may be needed during a season. The first survey is usually the most time-consuming and expensive because of the assembling of photographs or maps. Subsequent surveys are made more easily because all photographs are assembled and merely need to be taken off the large plywood sheets and put on the smaller boards. Previously marked infestations are removed with carbon tetrachloride so that observers start out with clean photographs on each survey.

Most planimetric and 15-minute (or smaller) U.S.G.S. charts are not satisfactory for plotting infested spots. The maps lack sufficient detail and the small scale prevents accurate location of scattered small infestations, especially when they occur in great numbers. However, large scale detailed planimetric maps (7½-minute quadrangles, scale—1:24,000) such as are available in the T.V.A. region, have been used effectively in hilly country and can be substituted for aerial photographs. The 7½-minute quadrangles show all cultural features, topography, and usually have a green overlay representing forested areas. When these charts are glued together in long strips and advanced between two rollers they can be used in the same manner as the aerial photographs.

Most foresters and forest entomologists make excellent aerial observers because of their familiarity and training with maps and aerial photographs. In the air, rapid orientation and ability to track on aerial photographs is a prime necessity. Aerial observers undergo a high level of constant concentration; rest is possible only when flying between adjacent flight lines. Fatigue and loss of efficiency, evidenced by overlooking infestations that would normally be plotted, was noted when surveying was carried on longer than 2½ hours at one time. Consequently, two flights a day, one in the morning and one in the afternoon, are planned so that time on flight lines is seldom in excess of 2½ hours. Ferry time to and from airports is not included.

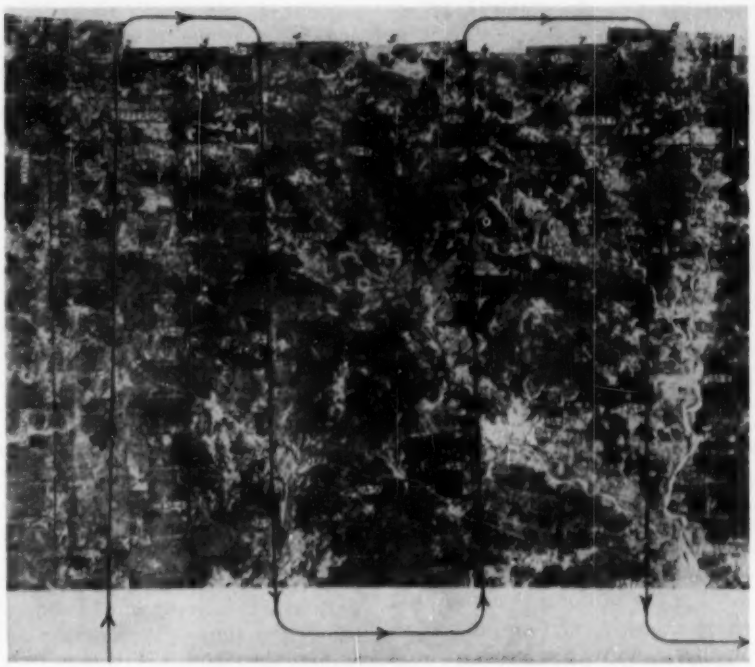

FIG. 3.—Index mosaic showing location of flight lines drawn along the edge of each odd column of photographs for 100 percent coverage.

Description of the Ground Phase

In aerial surveys of the southern pine beetle infested spots marked on aerial photographs are indicative only of that portion of the infestation where the trees have faded to a yellow or red-brown color. On the periphery of the infested spots additional trees often occur which have been attacked but which have not yet faded. Therefore, area estimates of discolored timber obtained with the dot template on marked photographs or maps do not represent a true picture of total acreage of infestation. They show mainly the location of infested spots. Therefore, accurate estimates of total infested acreage are made by checking several spots from the ground.

A ground examination of about 5 percent of the infested spots is made to estimate to the nearest 0.1 acre both the discolored and green infested timber. For example, on the Homochito National Forest, timber markers measured the infested area in both of these categories in connection with their marking of the timber for salvage. By averaging such measurements, a ratio of total area of infestation to area of discolored timber was computed and applied to the entire area by multiplying the sum of the discolored acres measured on the photographs by this ratio derived from ground tallies. From this information it is also possible to obtain an index of the aggressiveness of the outbreak and predict future control needs. On a survey conducted in late July 1952, this ratio was established to be 1.7:1.0. A survey made 6 weeks later showed a decrease in this ratio to 1.56:1.0. In June 1953, it dropped still lower, to 1.22:1.0. As this ratio ap-

proaches 1:1, the number of infested green trees approaches zero and the threat of further timber loss diminishes. The size of the average infested spot dropped from 4.1 acres in July to 3.3 acres in September and to less than 0.25 acre in June of the following year, which also indicated a somewhat less aggressive outbreak.

Results

The plotted and assembled photographs mounted on the master boards are made available to the timberland owners. Large owners, such as lumber and pulpwood companies and federal agencies, usually have photographic coverage of their holdings. They can transfer the plotted infestations onto their own photographs or maps for subsequent use in the field. It is relatively simple to find an infestation on the ground when its location is narrowed down within small limits, and to plan access roads for logging and spraying equipment. However, smaller timberland owners are generally unaware of timber insect problems or that southern pine beetle infestations are killing trees on their property until the aerial survey showed up the infestations. In Mississippi and Texas, state foresters visited all such properties and attempted to acquaint the owner with the problem and to help him find markets for his salvageable timber and to assist him in controlling the infestation. The estimated total acreage involved and predictions of future control needs were also made available to the land managing agencies, for planning and administrative purposes.

Based on three aerial surveys made in Mississippi in 1952 and 1953, it was possible to arrive at a reasonably good estimate of cost. For each survey, an area of 1½ million acres was covered in about 25 hours of flight time. Salaries and per diem of pilot, two observers, and draftsman, plus aircraft operating expenses and purchase of aerial photographs, cost about $0.43 per 1,000 acres (or $0.00043 per acre).

Since there has never been a 100 percent ground survey over a large area for locating southern pine beetle infestations, it is difficult to make a direct comparison between ground and aerial surveys as to costs, accuracy, time, and personnel involved. However, on the basis of time to cruise "bug" trees in California (which is not directly comparable to Mississippi because of terrain and timber type) at the rate of 1 section per day for each 3-man crew, it was calculated that it would require 20 crews 24 working days to cover only 13 of the 72 infested townships covered by air. This represents an estimated cost of $20,000.00 ($66.70 per 1,000 acres). Dependence on ground cruises alone is untenable when the dynamic nature of the southern pine beetle with four to six generations per year is considered. It is unthinkable to use ground methods when five times the area can be covered at 1/20th the cost by four men in ten working days by aerial plotting.

Additional advantages of the aerial method are listed as follows: (1) an estimate can be made of acreage needing treatment on private, state and federal lands from the final plotted map when coupled with ground observations; (2) an appraisal of the entire outbreak is available for intelligent planning of funds, manpower, and materials needed on control operations; (3) by inspection of the marked photographs when assembled on the large plywood sheets, control efforts can be centered on areas showing a high frequency of beetle infestation, (timber sales can be administered more efficiently and hot spots in beetle activity will be eliminated at the same time); (4) entomologists can follow the progress and trend of the outbreak by comparing maps from successive surveys and by watching the aggressiveness of the beetle population (this aggressiveness is expressed as a ratio of total area of infestation to area of discolored timber and as the ratio approaches equality denotes either success of the control operation or a natural decline in the epidemic); (5) many timber-using industries and state forestry departments now own their own airplanes and can conduct an aerial survey of the nature described above with their own men and equipment.

One limitation of the aerial surveying method is the inability of the observers to detect and map all single discolored trees; flying around smaller areas at a lower altitude is the recommended procedure during such stages of the epidemic. However, following a severe outbreak, when the presence of beetles occurs only in single trees or small groups during the growing season, it is almost always a manifestation that the insect populations are no longer in the epidemic stage. In conclusion, no known ground method of surveying can approach the aerial method described in speed of execution, area covered, low cost, and rapid presentation of data for control operations.

Summary

1. Almost 112 million board feet of saw timber and pulpwood was killed by the southern pine beetles from 1950 to 1952 in Texas and Mississippi. The majority of this volume was salvaged; however, because of blue stain and degrade its stumpage value was only ⅓ that of healthy timber.

2. For conducting control operations against explosive southern pine beetle outbreaks, a survey method was required which would cover the area rapidly at a reasonable cost. The aerial method described in this paper satisfies these requirements.

3. High wing monoplanes with seating capacity to accommodate a pilot and two observers are most efficient. Slow flight speeds below 90 miles per hour are essential.

4. Aerial photographs (scale 1:20,000) and index mosaics (or large scale planimetric maps 1:24,000) of the outbreak area are needed and can be purchased from appropriate land managing agencies if not already available. For ease in handling in airplanes, photographs along a flight line are stapled together and attached to plywood boards (20 by 36 inches).

5. Aerial observers are able to

detect and plot southern pine beetle infestations on these aerial photographs when flying in a slow-moving airplane at 3 to 5 thousand feet above the ground. The infestations are marked on the photographs with red china-marking pencil by matching identical landmarks on the ground and on the photographs. Orange or amber filters (in the form of goggles or face shields) worn by the observers help accentuate beetle killed timber and permit surveying under hazy conditions. Most foresters and forest entomologists make good observers because of their familiarity with aerial photographs and only require training in recognizing southern pine beetle damage from the air.

6. Marked photographs are reassembled by counties and infestations are measured to the nearest half acre by means of a dot template. The locations of the infestations are transferred to other photographs or maps for use in the woods by salvage and control crews.

7. Ground samples taken during salvage and control operations of about 5 percent of the total number of infested spots are sufficient to permit computation of a ratio of average area infested to average discolored area seen and plotted from the air. This ratio provides a basis of comparison for insect aggressiveness from one survey to the next. In addition, the product of this ratio and the total discolored acreage provides an estimate of total acreage infested. This figure is needed in the administration of a control program.

8. Aerial observers can view and locate infestations at the rate of about 60,000 acres per hour. Cost of making a 100-percent aerial survey of this type is approximately $0.43 per 1,000 acres. Three to five aerial surveys may be needed in any one year dependent upon activity of the southern pine beetle and how soon natural and man-devised control factors become effective in reducing the beetle to an endemic level.

9. One limitation of this method is the difficulty of accurately plotting all single trees or areas less than ¼ acre in size.

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2. CANN, JAMES J. Dec. 15, 1952. The beetle battle—a fight for survival in Mississippi. Southern Lumberman.

ELWOOD L. DEMMON, president of the Society of American Foresters and director of the Southeastern Forest Experiment Station at Asheville, N. C., was awarded the honorary degree of doctor of science on May 29 by North Carolina State College.

The citation honoring Dr. Demmon stated: "A native of Indiana, Demmon received his college training at the University of Michigan, from which he holds a Bachelor of Arts degree and a Master of Science degree in Forestry. He has had a long and distinguished career in forestry research, both in this country and abroad. His important contributions to the fields of forest management, forest genetics, watershed conservation, and forest products as well as his public service as adviser and consultant in forestry have won for him an international reputation."

Growth Behavior of Northern Hardwoods After a Partial Cutting

Adrian M. Gilbert, Robert W. Wilson, Jr., and Russell J. Hutnik
Foresters, Northeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, Upper Darby, Pennsylvania

The authors trace the development of a northern hardwood stand for 15 years after an experimental partial cutting. Their analysis of growth behavior leads to some practical recommendations for managing northern hardwood stands.

How DO northern hardwood stands in New England react to partial cutting? To find an answer to this question, the growth behavior of stands on the Bartlett Experimental Forest, Bartlett, N. H., has been studied for a 15-year period.

The study was limited to uneven-aged stands that contained remnants of old-growth northern hardwoods. In their original state the stands probably had two-thirds of their volume in beech, sugar maple, and yellow birch. Softwoods(hemlock and red spruce) probably made up one-fourth of the volume. Stocking was heavy—about 140 square feet of basal area per acre.

Beginning about 1880 and continuing to the turn of the century, the area was logged several times. The first cutting was for spruce logs. Then the sugar maple and yellow birch were cut. During World War I, hemlock was cut for its bark. By 1933 the forest was again well stocked.

The Treatment

A typical stand of 30 acres was selected to test the merits of light partial cuttings in comparison with the usual heavy commercial cuttings. A series of sample plots was set up within the stand. The first plot was established in 1933; it was cut that winter. The plot consisted of ten ¼-acre subplots; it was surrounded by a 1-chain isolation strip.

Another plot was cut in each succeeding year (except 1938, when the hurricane damaged the stand), until there were five. The total area of the treated plot was 12½ acres. In all, a block of 25 acres was cut.

The cuttings were fuelwood operations, removing about one-third of the basal area. They removed poor-risk trees, defective trees, and trees that were interfering with the development of better trees. Trees in all size classes were cut, but some of the large defectives had to be left to avoid excessive openings in the stand.

When each plot was set up, each tree in it was permanently numbered and its diameter was recorded to the nearest 1/10 inch. Since the plots were cut in different years, the effects of yearly weather variations tended to average out.

For comparison with these treated plots, a 2½-acre untreated check plot was set up in the stand. And in addition, 48 other ¼-acre plots in similar untreated stands were used for supplementary check data.

Measurements of the plots were made at 5-year intervals. Basal area (in gross square feet) was used as the unit of measure. All data were based on merchantable trees plus cull trees.

(Basal area was used because it is independent of height and is applicable over a wider range of site conditions than volume measurements. It is also well suited to extensive management control because it is easy to compute. For all-aged stands, growth rates computed in basal area will not differ greatly from growth rates in cubic feet. In any case they will be conservative.[1])

Growth computations were made for each of three 5-year periods and for the total 15-year period. Simple interest rates were used.

The four major species of the stand (beech, yellow birch, sugar maple, and hemlock) were considered individually in the analysis. All the other species (red maple, red spruce, paper birch, and white ash), which make up only a small part of the stand, were grouped.

Four diameter groups were recognized: poles, 5 to 10 inches d.b.h.; small saw timber, 11 to 15 inches; medium saw timber, 16 to 20 inches; and large saw timber, 21 inches or more.

Development of the Treated Stand

In 1933, when the records were begun, much of the stocking was in big decadent hardwoods, holdovers from the old-growth stand. Trees about 60 years old were also well represented in the upper and intermediate crown classes. A fair stand of reproduction was unevenly distributed over the tract.

We cannot determine the amount of cull from the available records. The best guess is that the stand was 35 to 40 percent cull. About two-thirds of this was in cull trees (less than 50 percent merchantable volume), mostly in the larger size classes. A light partial cutting could not remove all cull material at once. The cutting probably reduced the cull to 10 or 15 percent.

There were some differences between the treated and untreated stands before cutting. The proportion of beech was 25 percent higher in the treated stand. The treated stand also had more of its stocking in the larger size classes. The stockings per acre were as follows:

	Basal area *Sq. ft.*
Treated stand	123
Check stand	110
Supplementary check plots	124

During the 15-year period after cutting, species composition and structure of the treated stand changed. The proportion of hemlock and sugar maple increased at the expense of beech (Table 1). Since the proportion of beech was so high, the over-all development of the stand reflected largely what happened to beech. At the end of

[1]For converting to other units of measure, the following rough factors may be used: 1 square foot of basal area = 20 to 25 cubic feet = ¼ standard cord = 120 board feet. These factors are based on all trees 5 inches d.b.h. and larger for converting to cubic feet and cords; and on all trees 11 inches d.b.h. and larger for converting to board feet.

the period the basal area distribution was still somewhat short of the goal: there were surpluses in the two middle diameter groups, and shortages in the pole and large sawtimber classes (Table 2).

The development of the treated stand and the untreated stand during the 15-year period can be summed up this way:

	Treated stand	Check stand
	Basal area per acre (sq. ft.)	
Initial inventory	123	110
Removed by cutting	34	—
Residual	89	110
Hurricane yield	12	—
Residual	77	110
Production	17	5
Final inventory	94	115

All the material blown down by the hurricane (about 13 percent of the volume) was salvaged; so it was considered as yield rather than mortality. Wind losses were mostly among the larger trees, though many small trees were also damaged by breakage and exposure. On the check stand only one small tree was lost.

Analysis of Growth

Analysis of growth was based on the 15-year period after cutting. Since the inventories were complete, we were able to separate growth into these components:

Average annual diameter increment is expressed in hundredths of inches and is based upon growth during a period. Diameter increment is well suited for measuring growth by size classes.

Accretion is growth on the initial trees. These are all trees that were at least 4.6 inches d.b.h. at the beginning of the period. Accretion includes growth on those initial trees that were cut during the period. However, growth on trees that died is ignored.

Mortality is the volume of initial trees that died during the period.

Net growth is accretion minus mortality.

Ingrowth consists of the volume, at the end of the period, of those trees that grew into the lowest inventoried diameter class during the period.

Production is the sum of net growth and ingrowth; that is, the change in volume of the stand during the period. Production is a measure of the growth on an *area* as compared to accretion on initial trees.

We felt that by distinguishing between accretion and production, the data may be compared more easily with similar data from other areas with different amounts of ingrowth and mortality. On a small area, such as the one considered here, the death of one or two large trees might completely distort net growth figures. By separating accretion and production, we can not only compare the data better, but can also see how these stands develop. In general, accretion is the best measure of the immediate effects of a treatment upon a stand.

TABLE 1.—DISTRIBUTION OF TOTAL BASAL AREA BY SPECIES

Species	Initial stand	Residual stand	Stand 15 years later	Goal
	Percent			
Beech	76	71	68	30
Sugar maple	11	12	14	30
Yellow birch	6	7	6	10
Hemlock	4	6	8	20
Other	3	4	4	10
Total	100	100	100	100

TABLE 2.—DISTRIBUTION OF TOTAL BASAL AREA BY DIAMETER GROUPS

D.b.h. group (inches)	Initial stand	Residual stand	Stand 15 years later	Goal
	Percent			
5-10	16	19	19	25
11-15	27	33	30	29
16-20	35	33	35	28
21+	22	15	16	18
Total	100	100	100	100

TABLE 3.—GROWTH OF ENTIRE STAND DURING 15-YEAR PERIOD, IN BASAL AREA PER ACRE

Growth component	Treated stand	Check stand
	Sq. ft.	*Sq. ft.*
Accretion	24.0	22.6
Mortality	10.7	20.6
Net growth	13.3	2.0
Ingrowth	3.7	2.8
Production	17.0	4.8

Growth of Entire Stand

For the 15-year period, production in the treated stand was more than three times that in the check stand (Table 3).

Although there was substantially less growing stock in the treated stand—77 square feet as compared to 110—accretion was slightly higher than in the check stand. And this growth was concentrated on trees of better quality. The average annual accretion in the treated stand was more than 1.5 square feet of basal area per acre.

The high mortality figures are startling. Even in the treated stand, where many of the poor-risk trees were cut, loss through mortality amounted to almost 14 percent of the growing stock.

As expected, ingrowth was greater on the treated stand. However, this ingrowth made up only a small fraction of the total production on the treated stand as compared to more than half on the check stand.

Rates of growth may reveal more about a stand's performance than actual figures. The supplementary check plot data can be used to compare the treated and untreated stands in terms of average annual rate of accretion:

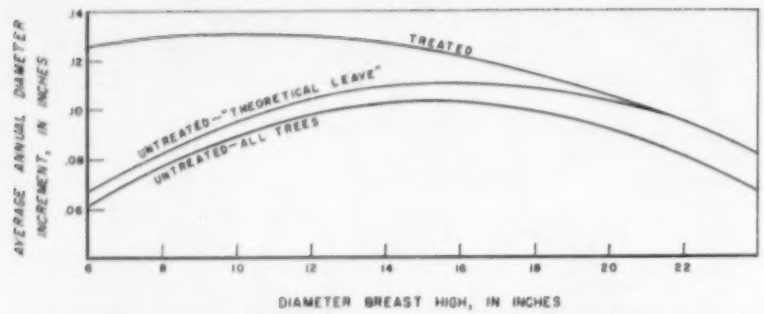

FIG. 1.—Average annual diameter increment in treated and untreated northern hardwood stands.

TABLE 4.—AVERAGE ANNUAL GROWTH RATES BY SPECIES, 15-YEAR PERIOD

Species	Treated stand				Check stand: accretion
	D.b.h. growth	Accretion	Mortality	Ingrowth	
	Inches	*Percent*			
Hemlock	0.13	2.9	(1)	0.3	1.9
Sugar maple	.14	2.1	0.3	.5	1.6
Beech	.13	2.1	1.1	.3	1.2
Yellow birch	.09	1.6	.9	.1	.8
Average	0.12	2.1	0.9	0.3	1.4

[1]Less than 0.05 percent.

	Accretion rate
	Percent
Treated stand	2.1
Check stand	1.4
Supplementary check plots	1.6

Two things could account for the increase in rate of accretion after cutting: (1) the response of the individual trees to release, and (2) the removal of the slower growing trees. The relative importance of these can be determined.

When the first measurements were made in the check stand, the trees were sample-marked on the same basis as the treated stand. Thus, the "theoretical cut" trees could be separated from the "theoretical leave" trees. By comparing just the "theoretical leave" trees on the check stand with the trees that were actually left on the treated stand, we can determine how much of the increased growth was due to response to release:

	Accretion rate
	Percent
Treated stand	2.1
Check stand: "Leave"	1.7
Check stand: "All"	1.4

The relative importance of the response to release and the removal of slower growing trees varied by size classes (Fig. 1). For the smaller trees, the response to release was more important. This is the difference in diameter increment between the trees in the treated stand and the "theoretical leave" trees. For large trees, the removal of slower growing trees was more important. This is the difference between the "theoretical leave" trees and all trees in the check stand.

It is also noteworthy that the accretion of the treated stand varied by 5-year periods:

5-year period	Treated stand	Check stand
	Basal area per acre (Sq. ft.)	
1	7.4	7.9
2	9.4	7.7
3	7.1	7.0

The comparatively low growth during the first period was probably a result of the double shock of the cutting and the hurricane. This largely offset the advantages of the reduced competition. It wasn't until the second period that the stand recovered. During this period, accretion reached its peak. The fact that there was no similar trend in the untreated stand shows that the increased growth cannot be attributed to the possibility of more favorable climatic conditions. Most of the drop in accretion between the second and third periods was caused by the beech scale-Nectria infestation.

The mortality rate was lower in the treated stand than in both the check stand and the supplementary check plots:

	Mortality rate
	Percent
Treated stand	0.9
Check stand	1.3
Supplementary check plots	1.2

There was, of course, almost twice as much mortality in the check stand as there was in the treated stand.

In the check stand, the "theoretical cut" trees have a mortality rate of 2.4 percent, as compared to 0.8 percent for the "leave" trees. This difference emphasizes the presalvage value of the partial cutting.

Growth by Species

Each species has its own growth characteristics. Knowledge of these helps to determine how to handle the stand and what is the desired composition.

Hemlock was apparently the fastest growing species (Table 4). It had better than average annual diameter increment, the highest rate of accretion, negligible mortality, and average ingrowth. Hemlock also made the best response after cutting; its rate of accretion was 1 percent higher than the check stand's.

Sugar maple ranked second. It made the fastest annual diameter increment. Its rate of accretion was average, ingrowth high, and mortality low. However, sugar maple made the least response to cutting.

The size distribution of hemlock and sugar maple should be weighted. The 21-inch-and-larger diameter group included almost half the sugar maple basal area but only 5 percent of the hemlock. Most of these large trees were holdovers of low vigor from past cuttings. If we omit large sawtimber from the analysis, we find that the growth of sugar maple equals or exceeds that of hemlock.

The behavior of beech was er-

ratic. It grew at an average accretion rate of 2.1 percent. It made the second best response after cutting. But it had the highest mortality rate of all species. A closer look at beech growth is needed.

Beech differed from the other species in growth by periods (Fig. 2). The accretion rate of beech fell drastically during the third period in both the treated and the check stands. The beech scale-Nectria infestation caused this reduction.

This disease also caused the excessive mortality of beech. Since the first losses from the disease occurred in the early 1940's, the mortality during the first 5-year period can be considered normal for beech (Table 5).

These losses became increasingly greater in later years, and they finally exceeded accretion. The rate of loss has tripled in each successive 5-year period. Most of the mortality was in large trees.

Yellow birch, the most valuable northern hardwood species, behaved the poorest. Analysis reveals that: (1) It doubled its rate of accretion after cutting; (2) despite this excellent response, it still had the lowest accretion rate of all species—1.6 percent; (3) ingrowth was the least of all species; and (4) it had a high rate of mortality, especially in the smaller size casses.

Growth by Size Classes

Diameter increment was greatest in the small sawtimber class and fell off slowly for smaller and larger sizes (Table 6). This is a parabolic trend (Fig. 1). As expected, accretion and net growth rates decline as size increases.

Stocking

The fifty ¼-acre subplots on the five treated plots were sorted by basal area into three broad stocking levels:

Stocking	Area	Average Basal Area Per Acre Before cut	Start of period[1]
	Acres	*Sq. ft.*	*Sq. ft.*
Low	3.75	107	65
Medium	5.50	121	87
High	3.25	143	105

[1]The 10-year period following the hurricane.

TABLE 5.—ANNUAL BEECH MORTALITY RATE IN TREATED STAND, BY SIZE CLASSES AND 5-YEAR PERIODS

D.b.h. group (inches)	1st period	2nd period	3rd period
		Percent	
5-10	0.6	0.5	0.4
11-15	.3	.7	.7
16-20	.1	.5	2.1
21+	—	1.6	5.5
Average	0.2	0.7	1.9

TABLE 6.—ANNUAL GROWTH RATES BY DIAMETER GROUPS, 15-YEAR PERIOD

D.b.h. group (inches)	Average annual diameter increment	Accretion	Net growth
	Inches	*Percent*	*Percent*
5-10	0.12	3.6	3.1
11-15	.13	2.2	1.7
16-20	.11	1.4	.6
21+	.09	.9	−1.4
Average	0.12	2.1	1.2

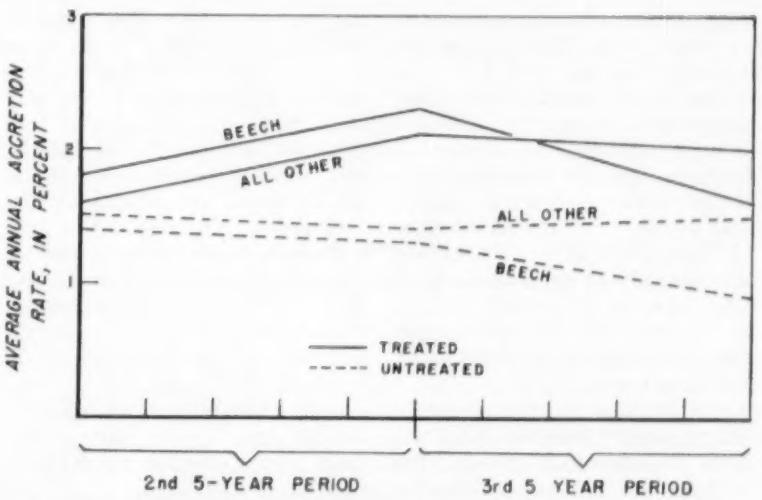

FIG. 2.—The accretion rate of beech fell during the third 5-year period.

The distribution of basal area by size classes varied with each level of stocking at the start of the period:

Size class	Low	Medium	High
Inches		*Percent*	
5-10	21	20	15
11-15	37	32	27
16-20	30	34	35
21+	12	14	23
Total	100	100	100

This distribution of basal area coincides with a general characteristic of balanced uneven-aged forests. That is, the higher the stocking, the greater the proportion of the total volume in the larger diameter classes.

Structure, stocking, and growth are related to each other (Table 7). During the 10-year period after the hurricane, the accretion on the low-stocked subplots was almost as much as on the high. Satisfaction with this response hinges upon product objective, since only 22 percent of it was in trees large enough to produce quality sawtimber. Accretion on trees 16 inches d.b.h. and larger was 5.75 square feet on the high-stocked subplots. This was almost twice that on the low.

TABLE 7.—INFLUENCE OF STOCKING ON ACCRETION AND STRUCTURE IN BASAL AREA PER ACRE[1]

Stocking	Accretion			Volume at start		
	Total	16 inches d.b.h. and larger		Total	16 inches d.b.h. and larger	
	Sq. ft.	*Sq. ft.*	*Percent*	*Sq. ft.*	*Sq. ft.*	*Percent*
Low	14.01	3.02	22	65	27	42
Medium	15.36	4.15	27	87	42	48
High	16.66	5.75	35	105	61	58

[1]For the 10-year period after the hurricane.

Summary

Twenty-five acres of previously unmanaged northern hardwoods were partially cut (30 percent) in the 1930's. Records were kept for half of this area and for a 2½-acre check stand. The growth behavior of these stands after 15 years has been analyzed.

During the 15-year period, accretion on initial trees was slightly higher in the treated stand than in the check stand. Mortality in the treated stand was only half that in the check stand. This, plus slightly greater ingrowth, accounted for a production on the treated area more than three times as large as that on the check stand. Accretion averaged a little more than 1.5 square feet of basal area per acre annually in the treated stand, comparable to an annual rate of 2.1 percent. The average annual rate of accretion in the check stand was 1.4 percent.

The increase in the accretion rate on smaller trees was due mostly to stimulation of growth; the increase in the larger diameter classes was due to removal of the slow-growing trees.

Hemlock and sugar maple made the best growth. While yellow birch was the slowest growing of all species, it doubled its rate of accretion after cutting. Its mortality was high. Beech grew at an average annual rate of 2.1 percent. Mortality of beech in larger trees was exceptionally high, especially during the last 5 years. This was due to the beech scale-Nectria infestation.

Average annual diameter increment by size classes was parabolic —highest in the small saw-timber class.

The treated stand was divided into three groups of subplots according to stocking. The high-stocked subplots had more than twice the volume in trees 16 inches d.b.h. and larger as the low-stocked. Accretion on the low-stocked subplots almost equalled that on the high, and the rate was better. However, most of this accretion was on small trees.

Recommendations

A few recommendations concerning uneven-aged northern hardwoods in New England can be made from this partial cutting on the Bartlett Experimental Forest and from other observations.

Partial cutting.—Partial cuttings that remove 25 or 30 percent of the initial volume are satisfactory silviculturally. The first cut or cuts will probably be in the nature of pre-salvage and improvement cuts. Where beech scale-Nectria infestations in original stands are heavy, a heavier cut may be necessary. If northern hardwood stands were managed permanently in balanced uneven-aged forests, partial cuttings would become synonymous with harvest cuttings.

Cutting cycle.—We recommend cutting cycles of about 10 years to get most of the benefits of partial cutting, as well as adequate control of the forest's behavior. If beech scale-Nectria attacks after the first operation, we advise subsequent light, frequent cuts.

Species composition.—The proportion of sugar maple and hemlock in the forest should be increased to about 30 and 20 percent respectively. Although yellow birch is the most valuable species, holding it is questionable where its behavior and quality are poor. In general, discriminate against beech in marking because of its low value and its susceptibility to scale-Nectria attack.

Basal area.—Hold about 80 square feet of basal area per acre in trees 5 inches d.b.h. and larger. This will ensure the maintenance of satisfactory growth rates and sawlog production, if the diameter groups are brought into balance. Where maximum production of bulk products is desired, the level of stocking may be reduced.

Stand structure.—For the sustained production of specified products, uneven-aged stands should have a balanced structure. This is an example of a balanced structure with 80 square feet of basal area:

D.b.h. group	Basal area
Inches	*Percent*
5-10	25
11-15	29
16-20	28
21+	18
Total	100

Of course, these percentages are guides for stands on average sites. By maintaining about 45 percent of the volume in medium and large sawtimber, more of the allowable cut can come from trees large enough to produce quality veneer and sawlogs.

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A Change in Ground-Water Level After Clearcutting of Loblolly Pine in the Coastal Plain[1]

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TOO MUCH WATER is a common problem of the lower Coastal Plain of southeastern United States. Surface runoff is sluggish, and in the case of the fine-textured soils typical of flat areas subsurface water moves very slowly. After heavy rains the ground-water table often rises to or above the surface for many days. High water tables hamper logging and woods operations by interfering with the use of heavy equipment. In some instances forest land owners have speculated on the possible benefits of improved drainage to facilitate operations and perhaps benefit tree growth. There is also some concern as to what effect forest cutting practices have upon water relations in Coastal Plain areas.

It has been reported that some heavily cut-over coastal areas are subject to inundation more frequently than before the timber was cut. This possibility is supported by the estimates of water used by forest stands. Trees with their deep root systems and long season of growth transpire larger amounts of water than do herbaceous and shrubby plants with shallower roots.

B. W. Wells[3] in a discussion of the plant communities of the Coastal Plain of North Carolina states: "The basic condition of level topography with low relief, coupled with that of the relatively high rainfall of the region (50 inches), develops, over most of the lower Coastal Plain, situations characterized by relatively long periods of high water table. These long periods of standing water are, of course, of profound significance in controlling the distribution of the vegetation." It follows that any operation which affects the water table or prolongs or lessens the period of standing water could have a decided effect on the vegetation of the area.

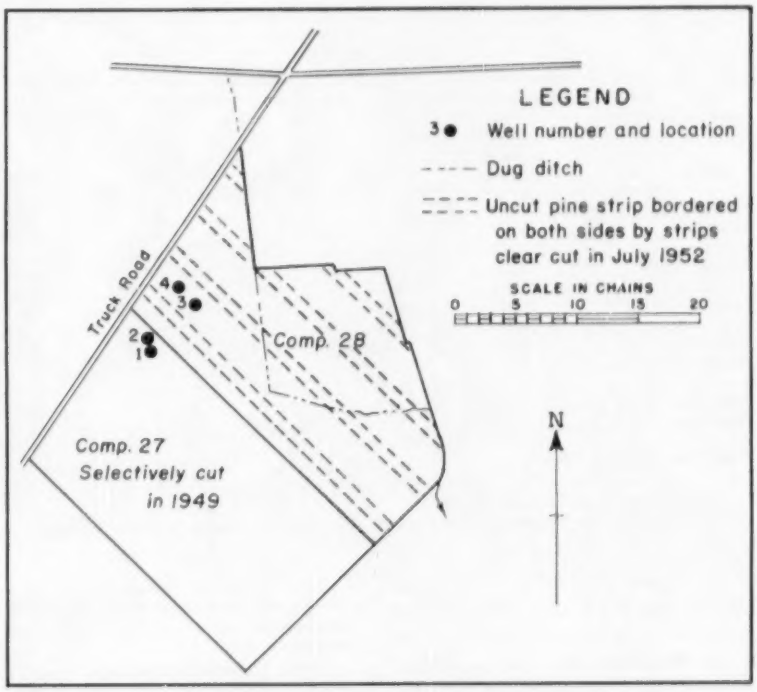

FIG. 1.—Study area showing location of permanent wells, drainage features, and forest stands.

Methods of Study

Planned tests of silvicultural systems which have been installed on the Bigwoods Experimental Forest, in Hertford County, North Carolina made possible a comparison of the effect of heavy timber cutting upon ground-water levels in similar areas. A pair of ground-water wells were installed in 1950 in each of two adjacent compartments. Compartment 27 had been given a first cut by a tree selection method in the fall of 1949. Compartment 28 had been uncut for at least 60 years, but a clear cutting in strips was planned for 1952.

The wells are cased with 10-inch-diameter perforated metal pipe and were dug 11 feet deep. Wells 1 and 2 in Compartment 27 are about 66 feet apart. Wells 3 and 4 in Compartment 28 are 130 feet apart and were located in the center of a 200-foot strip that was to be clear-cut (Fig. 1). The ground surface was assumed to be about 20 feet above sea level and varies less than 0.2 feet between the various wells.

Prior to the selection cutting on Compartment 27 in 1949, the forest was essentially similar on both compartments. It was a well-stocked stand of loblolly pine-hardwoods with a pine volume of 24,000 board feet per acre. About one-quarter

[1]This study was suggested by C. R. Hursh and planned by R. D. McCulley. Valuable assistance was provided by J. T. Stewart, H. K. Taylor, and Helen B. Burgess. The Bigwoods Experimental Forest, where the study was made, is the property of the Camp Manufacturing Company, Inc., of Franklin, Va. The forest is made available to the Southeastern Forest Experiment Station under a cooperative agreement.

[2]Formerly of the Southeastern, Hoover is now at the Rocky Mountain Forest Experiment Station, Fort Collins, Colorado.

[3]Wells, B. W. Plant communities of the Coastal Plain of North Carolina and their successional relations. Ecology 9 (2): April 1928.

TABLE 1.—NUMBER OF STEMS AND BASAL AREA PER ACRE OF ALL WOODY PLANTS ½-INCH D.B.H. AND LARGER FROM 1/5-ACRE CIRCULAR PLOTS WITH WELLS AT CENTER

Item	Uncut stand (Wells 3 and 4) Trees per acre	Uncut stand (Wells 3 and 4) Basal area	Selection stand (Wells 1 and 2) Trees per acre	Selection stand (Wells 1 and 2) Basal area
	Number	*Sq. ft.*	*Number*	*Sq. ft.*
All stems	517	196	452	123
Pine	98	116	150	98

TABLE 2.—AVERAGE PRECIPITATION IN INCHES AT HOLLAND, VA., COMPARED WITH PRECIPITATION AT COMO, N. C., DURING THE STUDY PERIOD

Month	Normal,[1] Holland, Virginia	Como, North Carolina 1950	1951	1952	1953
January	3.90	2.63	1.50	4.48	1.37
February	3.54	1.37	1.58	5.34	4.08
March	3.85	2.82	3.21	4.83	2.38
April	3.71	1.06	2.67	2.38	3.59
May	3.10	4.38	1.99	.84	4.09
June	5.00	4.45	5.71	5.05	5.90
July	7.26	9.99	2.73	4.64	.99
August	6.60	1.74	3.16	8.09	4.55
September	3.81	4.65	1.20	2.39	4.09
October	2.24	2.99	2.99	1.97	.47
November	2.64	1.55	5.22	4.88	2.39
December	2.42	1.87	3.07	2.75	4.04
Total	48.07	39.50	35.03	47.64	37.94
Total for Holland, Va.		40.68	40.41[2]	47.46	45.02

[1]Average based on 20-year record.
[2]Monthly total for February and August estimated because of missing records.

of the pines were old-growth trees 100 to 250 years old, and the remainder were second-growth trees 60 to 80 years old. The selection cutting in Compartment 27 removed all merchantable hardwoods and the largest of the old-growth pine (Table 1). The residual stand contains pines as large as 18 inches d.b.h. and its basal area is 123 square feet, of which 98 square feet is pine. An understory of switch cane (Arundinaria), other grasses, and shrubs is present.

On the stand to be clearcut in strips, the largest pine was 31 inches and the largest hardwood was 25 inches d.b.h. The basal area was 196 square feet per acre, of which 116 square feet was loblolly pine. The understory was predominantly switch cane and shrubs.

The soil on both compartments is a Bladen silt loam. It is fine-textured throughout the profile and both surface and internal drainage are very slow. A typical profile description for this soil on the Bigwoods is:[4]

Zero to three inches, dark gray (moist) to gray (dry) silt loam having fine crumb structure and containing numerous roots.

Three to seven inches, gray (moist) to light gray (dry) silt loam, of fine-granular structure; contains numerous roots.

Seven to twenty inches, gray (moist) to light gray (dry) very firm silty clay, slightly mottled or streaked with strong brown; very smooth, plastic, and massive when wet and hard when dry, breaking under strong pressure into small angular blocks ¼ to 1 inch in diameter. There are roots throughout most of the layer.

Twenty to thirty-five inches, gray (moist) to light gray (dry) very plastic clay, streaked or mottled with yellow and strong brown; when moist it is smooth, with a soft, putty like feel; when dry it becomes extremely firm, shrinks and cracks, and has a medium to coarse blocky structure. Cut surface of moist aggregates is brownish gray and has a shiny appearance. The upper portion of this layer has a few roots.

Thirty-five to sixty-five inches, mingled or mottled light-gray, brownish-yellow, and strong brown, smooth, soft, very plastic clay; upon drying becomes very hard, shrinks and cracks, and has a medium blocky structure.

The depth to ground water was measured and recorded each weekday morning from June 27 to December 6, 1950. Thereafter, measurements were made each Monday morning until March 10, 1952, when automatic water-level recorders were placed on Wells 1 and 3. Weekly measurements were continued at Wells 2 and 4.

Rainfall is not measured on the Experimental Forest but a record is available for Como, N. C., which is 3 miles northwest. Monthly values for this station are listed in Table 2 for the period 1950-1953. Rainfall for the year was below normal by 8 inches in 1950 and 13 inches in 1951. In 1952 the yearly rainfall was nearly normal although it was unusually dry in spring and early summer. In 1953 an abnormally dry July started a summer drought which extended through October.

Results

Ground-water elevations and rainfall are shown in Figures 2, 3, 4, and 5 for the period July 1, 1950 to December 31, 1953. Because there was little difference between Wells 1 and 2 and between Wells 3 and 4, only the records of Wells 1 and 3 are shown on the figures. It is apparent that during the summer of 1951 the water table in the selectively cut stand (Well 1) was higher than that of the uncut stand. While it is believed that this condition is an effect of the light cutting, it cannot be proven because no records are available for comparing the wells before the selection cut was made.

However, the records for Wells 1 and 3 before the cutting in 1952 do show the fluctuations of the water table as affected by the timber stand. During the winter months, water use by trees is slight and rainfall is sufficient to bring the water table to or near the surface. By May, evaporation and the taking up of water by vegetation lower the water table rapidly. During the growing season, heavy rains are required to raise the water table appreciably and rapid recession takes place thereafter. In the summer of 1950, rainfall was sufficient to hold the ground water to fairly high levels. In 1951, the summer months were dry and the water table fell until late October.

The 200-foot strip in which Well

[4]Lee, W. D. Preliminary Report—Soil survey of the Bigwoods Experimental Forest, Hertford County, N. C. Unpublished manuscript. Southeastern Forest Experiment Station.

3 is located was clearcut on July 22, 1952. All trees considered merchantable for saw timber or pulpwood were removed. When logging was complete, the area was open and only scattered small trees remained. A tally of the clearcut strip showed 120 stems with 14 square feet of basal area left from the original stand of 517 stems with 196 square feet of basal area. All pine trees were cut. Figure 4 shows that after cutting, the rapid recession of the water table at Well 3 halted, while at Well 1 in the timber stand the water table continued to fall. Between July 20 and August 2, there were 4.07 inches of rain, which caused a rise at both Wells 1 and 3. There were 5.66 inches of rain during the rest of August. In the clearcut area the water table rose 8.8 feet during the month of August, while in the selection stand the rise was 0.4 feet. During the remainder of the year the well in the clearcut area stayed at rather high levels, and on November 20, 1952 was 7.0 feet higher than Well 1. This is a complete re-

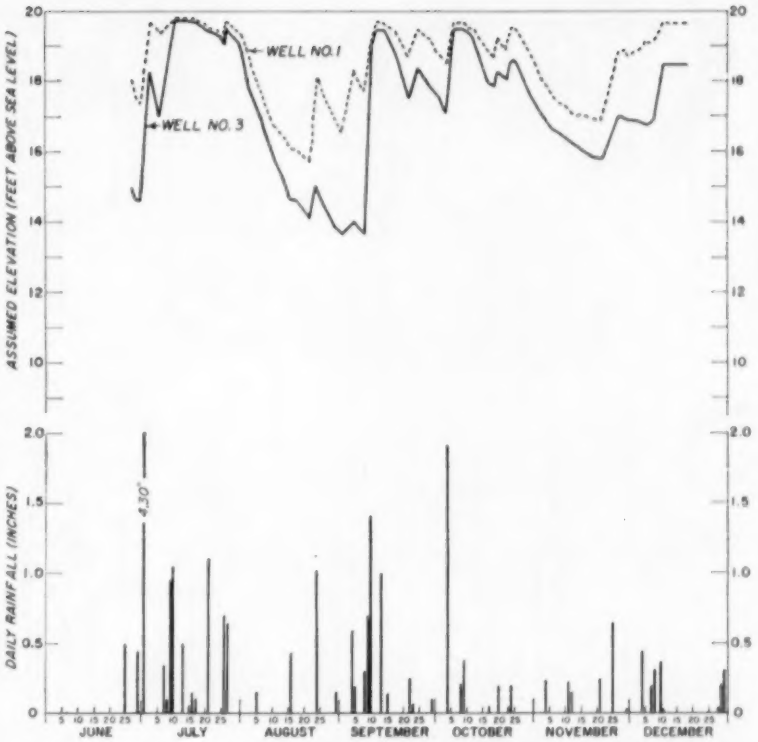

FIG. 2.—Ground-water elevation at Well 1 in a selection stand, at Well 3 in an uncut stand, and the daily rainfall during later half of 1950.

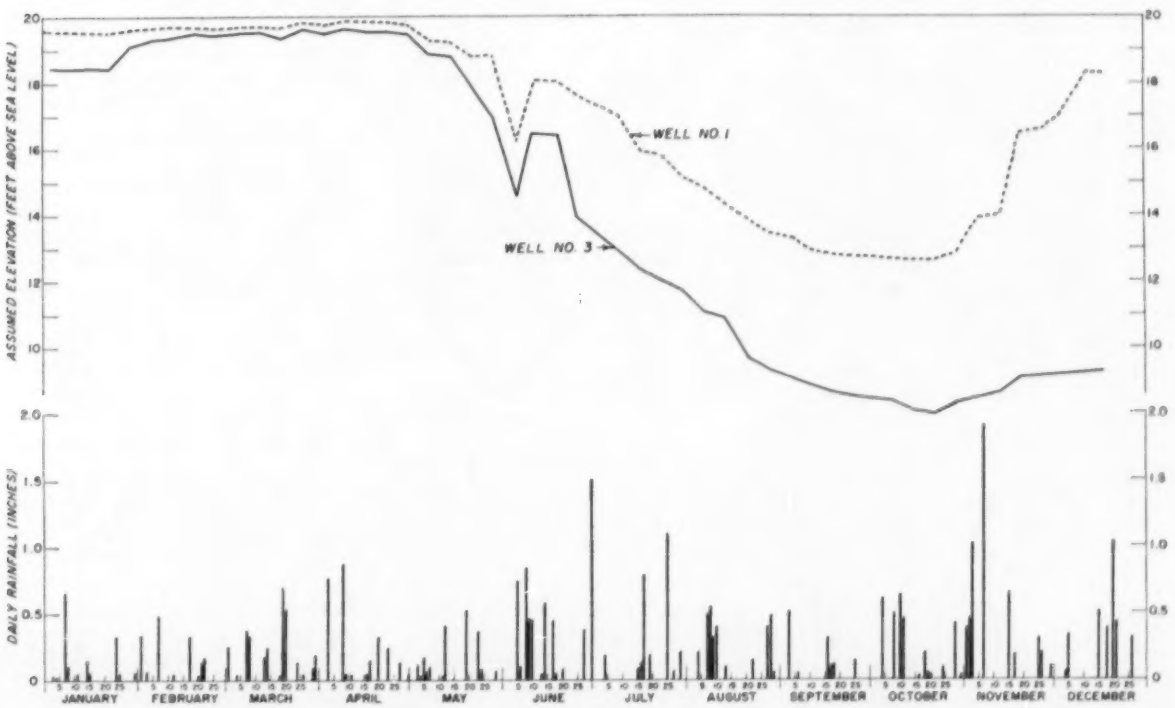

FIG. 3.—Ground-water elevation at Well 1 in a selection stand and at Well 3 in an uncut stand; also daily rainfall during 1951.

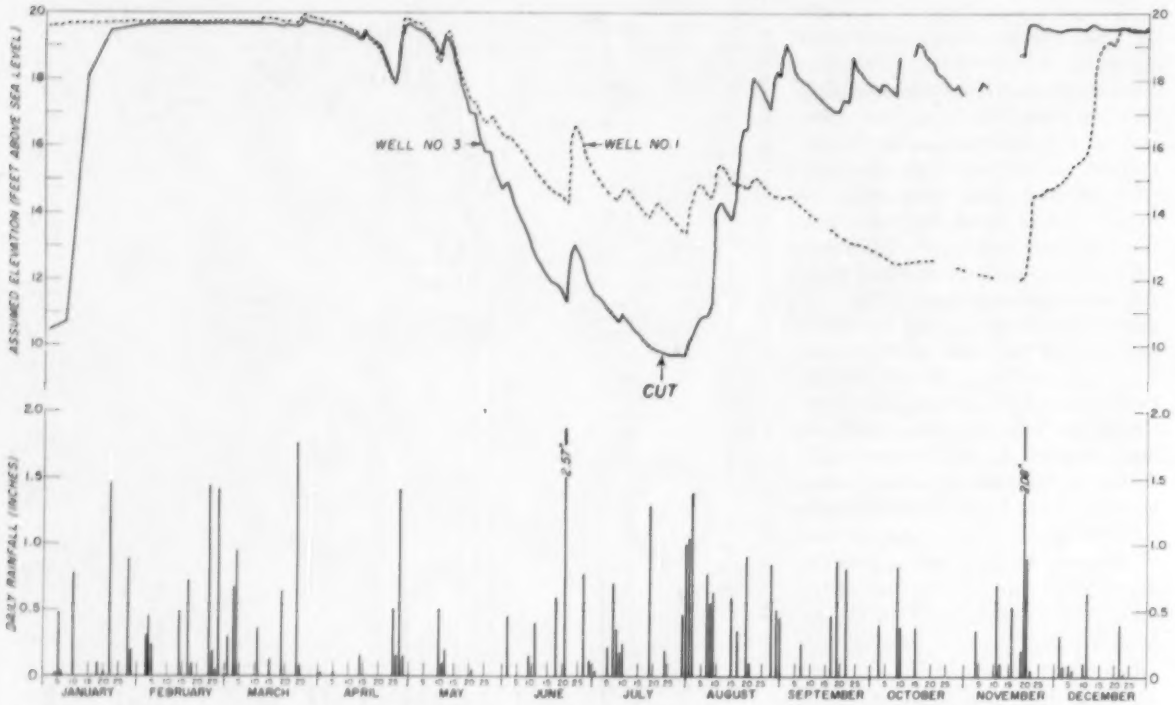

FIG. 4.—Ground-water elevation at Well 1 in a selection stand and the daily rainfall during 1952. Ground-water elevation at Well 3 in an uncut stand that was clearcut July 22.

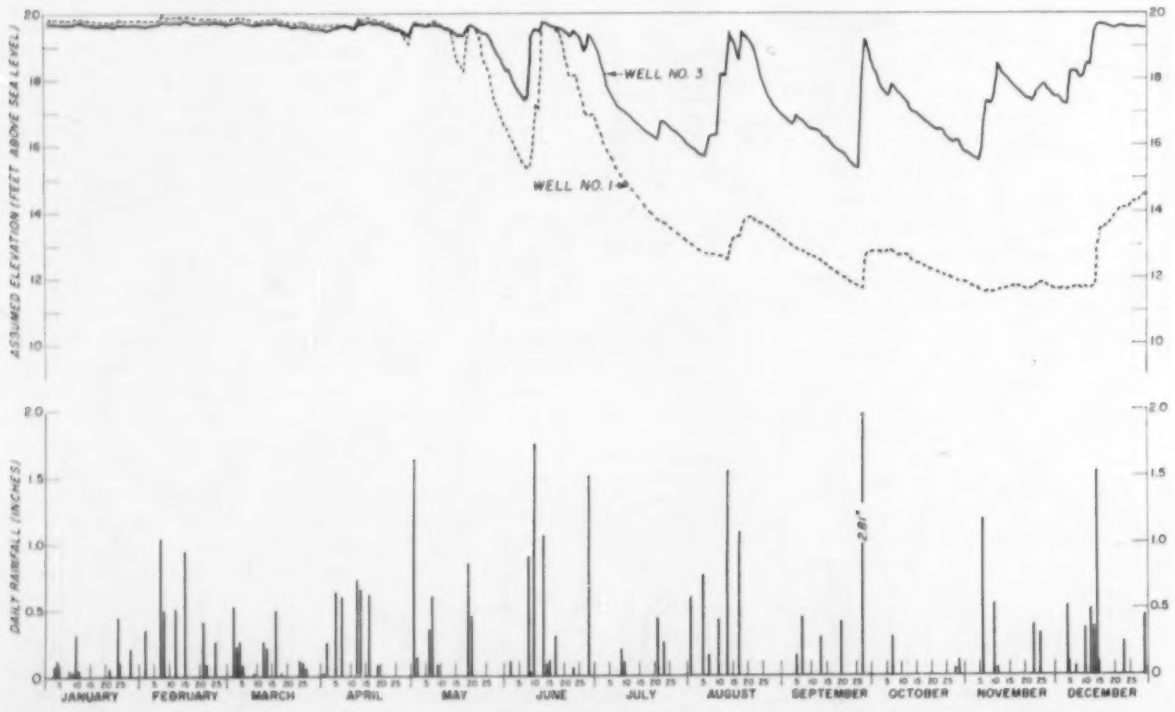

FIG. 5.—Ground-water elevation at Well 1 in a selection stand, at Well 3 in a clearcut stand, and the daily rainfall during 1953.

versal of the relationship that existed between the wells before the clearcutting. In fact, on November 20, 1951 (before the cut) the water table at Well 3 was 7.4 feet lower than it was at Well 1.

The relative position of the ground-water elevations in Wells 1 and 3 following treatment in 1952 was maintained in 1953. During May and June sufficient rain fell to maintain the water elevations at a relatively high elevation in both Wells 1 and 3. In July there was less than one inch of rain and at the end of this period the water elevation at Well 1 was about 3 feet lower than at Well 3 in the clearcut stand. In the first 17 days of August 4.55 inches of rain was recorded. In the selectively cut stand (Well 1) the water elevation rose about 1.3 feet to approximately 6 feet below the surface. In the clearcut strip (Well 3) the water-level elevation rose sharply to within 0.4 feet of the ground surface.

The difference in ground-water levels following the clearcutting (Fig. 4 and 5) suggested a very slow lateral movement of water in this soil. With two wells in the middle of a clearcut strip and two wells within a heavy forest stand, the question arose—where does the ground-water level dip? Was it a gradual decline, or was it closely related to stand edge?

In order to measure the water-table profile, 10 wells spaced ½-chain apart were dug. These wells were in a line extending from the middle of a cut strip through a leave strip, another narrow cut strip, and ending in the selection stand. With Wells 1 and 2, they formed a line of 12 wells extending from a point between Wells 3 and 4 in the center of a clearcut strip to Well 1, which is 2 chains within the selectively cut stand (Fig. 6).

Each new well was 10 inches in diameter, over 10 feet deep and not cased. Wells were topped with a metal drum or concrete culvert section to keep out surface water and to furnish a fixed point for measurements. Elevations were established for each well, so that all measurements could be reduced to a common datum.

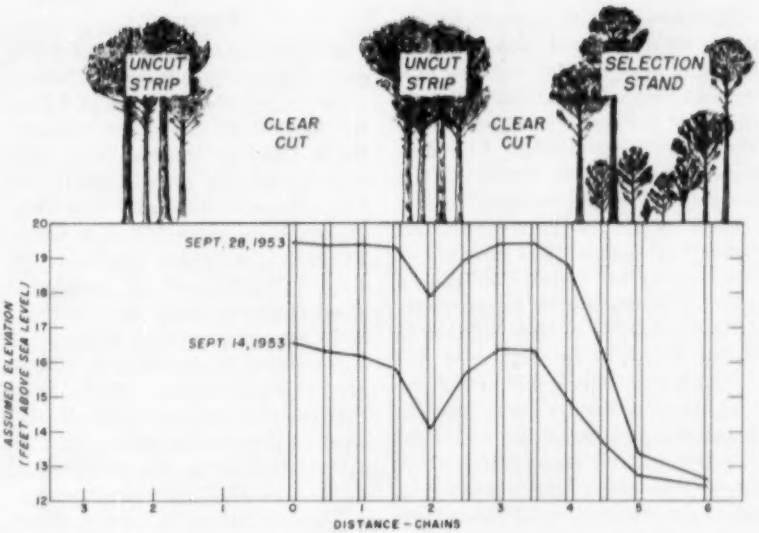

FIG. 6.—Typical water table profiles from a series of temporary wells extending from a clearcut area into a selectively cut stand. With reference to the map in Figure 1, this view is southeast.

Ground-water elevations in all wells were measured each Monday morning beginning August 31, 1953. During the subsequent 15 weeks the water table was highest in the clearcut strips, lower at the stand edges and lowest within the stands. Two typical water-table profiles are shown in Figure 6. By December 14, 1953 a heavy rain had saturated the strip-cut compartment and water levels in both the cut and uncut strips were at or near the ground surface. At this same date the water table was 7½ feet lower in the selection stand.

The extreme impermeability of this Bladen Soil is indicated by the slight lowering of the water table at stand edges and the sharp decline ½ chain within a stand. All wells within the clearcut strips show a uniformly high ground-water elevation.

Discussion

The halting of the rapid recession of the water table at Well 3 immediately after clearcutting and the large rise during August 1952 appear to be directly related to the clearcutting. The higher water level in the clearcut area than in the selection-cut area in 1953 supports this assumption. Comparison of the records before and after cutting furnishes no other explanation for the change in the relationships between the wells.

It can then be concluded that clearcutting does have an appreciable effect upon ground water on poorly drained Coastal Plain soils. It is possible that in years with heavy spring rainfall it may be difficult to regenerate pine stands on some poorly drained sites by clearcutting systems because of standing water on the prospective seedbed during the germination period.

It is common experience in the Coastal Plain for a logging job to bog down because of wet conditions. These wet conditions not only cause high logging costs but have led to heavy mortality of residual pine trees.[5] Difficult logging conditions generally occur in the winter months when the ground-water level is near the surface. As rainfall must be expected during any normal logging operation, it is suggested that these poorly drained areas be scheduled for logging during the growing season when the water table is down.

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[5]McCulley, R. D. Wet-weather logging may damage seed trees, Virginia Forests 5(5):6. 1950.

The results of this study with a dense timber stand, flat topography, and impermeable soil may represent nearly the maximum change in ground-water conditions occasioned by clearcutting. The pronounced change in depth to the water table which occurred immediately after the removal of the heavy timber stand is a measure of the large water demands of such a stand. Trees are evidently very efficient pumps tending to hold down water levels. The difference between water-table levels in the cut and uncut areas indicates the impermeable nature of the soil. Had the soil allowed more rapid water movement, much less difference in ground-water level would have been expected between the cut strip and nearby forest.

Summary

Ground-water observation wells were dug in adjacent compartments of the Bigwoods Experimental Forest located in Hertford County, North Carolina, in June 1950. Soils and topography are similar in the two compartments, and the wells are approximately 350 feet apart. The soil is a Bladen silt loam. In July 1952, the loblolly pine-hardwood timber around one group of wells was clearcut. As a result of this cutting, the water table rose to higher levels for the remainder of the growing season than it did where a forest stand was left. This same relationship was maintained during the 1953 growing season.

The ground-water profile, determined from a line of 10 temporary wells, emphasized the impermeability of the Bladen soil. The water table was lowered under a timber stand and under a 1-chain uncut strip, but at ½-chain or more into the clearcut areas the water table was not lowered by the adjacent timber.

The results of these studies may have a practical significance in developing silvicultural systems for the poorly drained soils of the Coastal Plain and throughout the flatwoods, where surface drainage is extremely slow. Heavy cutting may conceivably create soil conditions unfavorable for successful seedling establishment. If this proves to be the case, other systems of cutting that will have less immediate effect on soil moisture and ground-water levels may be needed in particular areas.

Trouble Shooting in the Wood-Working Industry

Trouble shooting in the wood-working industry will be covered for the fourth consecutive year in an intensive one-week course to be held at the University of Michigan Wood Technology Laboratory in Ann Arbor, August 8 through 13. The course, designed for plant managers, superintendents, quality control engineers, foremen, etc., in all segments of the wood industry, emphasizes analysis of costly reject parts in all stages of manufacture to determine the cause and corrective measures that can be taken. The prevention of production defects which can constitute an appreciable financial loss is also stressed.

The extensive laboratory facilities of the Department of Wood Technology, which is a unit of the School of Natural Resources, will be used in the course. The teaching staff consists of S. B. Preston, course director, A. A. Marra, N. C. Franz, and G. P. Bruneau, all regular faculty of the University of Michigan, and S. D. Pryce, lumber buyer and director of the Quality Control of the John Widdicomb Company, Grand Rapids.

Because much of the program involves individual participation, the enrollment must be limited to 18 persons and advanced applications are necessary. These can be made by writing to the Institutes Department, University of Michigan Extension Service, Ann Arbor.

Fire as an Enemy, Friend, and Tool in Forest Management[1]

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Bureau of Indian Affairs,
Washington, D. C.

WILD FIRE has caused tremendous damage in the forests of America. To make the public more aware of such fact and of necessity of extreme care in use of fire, intensive educational campaigns are being conducted by various conservation and protection agencies and by the forest industries. These are necessary, for it is far preferable to attempt to prevent fires. Once they start great damage sometimes results, despite the efforts of the most efficient control organizations. Proper control of fire is the key to success in forest management.

Less generally known is the fact that past fires have also been responsible for present distribution and character of growth of a number of our most valuable forest tree species and that regeneration and development of some of these species under management is dependent to a large extent on continued use of fire under proper control. There is sometimes reluctance to accept such facts by people who believe or who have been taught to believe that fire is an unmitigated evil in the forest. Such reluctance may be explained in part, as one forester has suggested, by the past tendency to minimize fire as one of the natural long-standing ecological factors and to classify its status improperly by ranking it entirely as a "man-caused" or "biotic" factor (*16*).

This writer believes that success in forest management is dependent on knowledge of fire in all of its aspects, not only in its control as a destructive agent but including its ecological role in development of the primeval forest and possible benefits that may result through its employment as a tool in control of stand conditions, in regeneration and in hazard reduction. Such role of fire and possibilities of use have been thoroughly explored in several of the more important forest types and prescribed burning is now utilized as a management tool.

In the southern pine region, as an example, longleaf pine (*Pinus palustris* Mill.) survives and thrives under conditions of frequent periodic burning. This is due to its habit of concentration growth in the root during an initial period of about 5 years and its ability, through food stored in the root, to put out new needles in the spring following defoliation by fire. It also has a fire resistent bud, abnormally thick and fire resistant bark and sparse branching as a sapling, which renders crown fires less likely (*3*). Such characteristics have developed over many centuries of burning, extending back to before the coming of the Indians (*25, 3, 7, 8*). The Indians and later the white settlers engaged in frequent woods burning at irregular intervals, averaging at least once every 3 or 4 years (*25*).

Great changes have since occurred. Clearcutting and steam skidders have denuded large areas and range hogs, seeking edible bark, have destroyed the longleaf seedlings (*25*). Annual fires have also been damaging, because the seedlings can be easily killed the first winter or spring following germination and because of the weakening effects of annual defoliation (*3*). Foresters concluded that burning was detrimental and was the limiting factor in good forestry practice (*11*).

Later, foresters observed that longleaf pine failed to reproduce or even to survive on areas where fire had been long excluded. In the absence of periodic fires at approximate 3-year intervals the small seedlings were attacked and stunted by a needle blight. In the meantime, as a result of this and the longleaf's naturally slow start in height growth, other less fire resistant tree species and shrubs of low value captured the ground (*25, 4*). Fire hazard increased to an alarming extent and wildfires became very destructive (*3*). Chapman concluded that total fire exclusion results in defeating the basic purpose of silviculture, which is perpetuation of the type through securing natural reproduction, and predicted that should it be maintained, longleaf pine, the most valuable tree of the South, would disappear as a species (*4, 3*).

From his studies and experimentation, Chapman developed a prescribed burning treatment schedule that assures perpetuation of longleaf pine (*6*). Such treatment is now widely used as a management tool in the South by the Forest Service of the Department of Agriculture and by other forest landowners and managers (*1, 11*).

Fire has also been found to be of primary ecological and silvicultural significance in other species of southern pine (*5*), in the pine-oak stands of southern New Jersey (*2, 17*), in the Norway-white pine stands of the Lake States (*24*), in the western white pine (*9, 33*) and in the Douglas-fir of the Pacific Coast (*10, 12, 21*).

From the role that fire has played in development of ponderosa pine (*Pinus ponderosa* (Laws.) and from tests that have been conducted, the writer believes that prescribed burning can also be used to considerable advantage in portions of the ponderosa pine region, particularly towards correction of some of the adverse conditions that have developed since coming of the white man. He believes that some of the adversely changed conditions threaten the success of sustained yield management, particularly the greatly increased hazard, contributing towards some of the recent devastating wild fires, invasion of inferior species in the understory and growth stagnation or near stagnation in dense reproduction over large areas. Silviculturists are concerned because of the exceedingly slow growth in some of these stands (*18*).

[1]This article represents the author's views and is not to be regarded as an official expression of the attitude of the Bureau of Indian Affairs on the subject discussed.

FIG. 1.—Even the heaviest stands experienced frequent surface fires. This suppressed tree of approximately 108 years was cut in 1949 from the midst of a dense even-aged group of ponderosa pines on Marshall Butte on the Fort Apache Indian Reservation in Arizona. Its basal "cat face" shows evidence of nine different fires, the latest occuring about 1898.

FIG. 2.—Dense even-aged ponderosa pine group from which was cut the "cat faced" suppressed tree depicted in Figure 1. Forest Guard Paul Amos is standing by the stump.

Fire as an Ecological Factor

That fire was an important ecological factor is indicated by the fire-scar and tree-ring record extending back many hundreds and even thousands of years, by stand characteristics and trends in succession in the absence of fire, as above illustrated for longleaf pine, by the testimony of early observers and by changes wrought by the white man.

The tree rings show age of the tree and record vicissitudes of its life. When fire scars are formed at the base of a tree, new wood grows from the still living edges of the cambium layer towards the center of the wound. The next fire interrupts the healing process and enlarges the wound. After occurrence of a number of fires, one can frequently observe in fire scars, or "cat faces," a whole series of interrupted healing calluses. By dating the rings to points where calluses occur, it is possible to determine with considerable accuracy dates when the various fires burned (*31*).

Data from the ponderosa pine region indicate that in earlier days fires occurred just as frequently as fuel accumulated in sufficient quantity on the forest floor, when weather conditions were favorable, and when some natural or human agency caused them to start. (Figs. 1 and 2). Lightning starts many hundreds and even thousands of fires in a year. Also in earlier days it is probable that Indians started many fires, either intentionally or by accident (*31*).

In the ponderosa pine region tree ring and fire scar studies have been conducted by Keen (*14, 15*), Show and Kotok (*23*) and others. In the Kartar area of the Colville Indian Reservation of north-central Washington the writer found from a fire scarred stump section that 23 fires burned during the period 1740 to 1920, inclusive. This indicates an average frequency of one fire each 8 years. Similar fire records abound in the area. In the ponderosa pine stands of the Southwest he dated various fire scarred stump sections, selected at random, with the assistance of the Tree Ring Laboratory of the University of Arizona (*31*) (Fig. 3). These indicated that fires burned as frequently as once each 4.8 years. One section, from the Kaibab National Forest, showed an average fire frequency of once each 11.9 years as far back as the year 1708. The writer also has reported on a study of fire as a thinning agent in dense immature ponderosa pine stands in the State of Washington (*28*). In the Southwest he has described stand conditions in the remote Malay Gap Area of the San Carlos Indian Reservation and in remote sections of the Fort Apache Indian Reservation, where frequent periodic fires have continued to recent date (*31*) Figs. 4 and 5).

John Muir, when exploring the Sequoia groves of the Sierra in 1875 found evidence of past recurrent fires that ". . . throw a sure light back on the post-glacial history of the species, bearing on its distribution" (*20*). Dr. Willis Linn Jepson, in his "Trees of California" (*13*), stated in part that "The Sierra Nevada forest, as the white man found it, was clearly the result of periodic or irregular firing continued over many thousands of years—as a result the Sierran forest shows marked reactions to millennial fire conditions. . . . Indeed the main silvical features, that is density, reproductive power and dominance of types, are in great part expressions of the periodic fire status."

Older whites and Indians have described fires of earlier days. Muir gave a vivid description of a fire observed in October 1875, in the forest between the middle and east forks of the Kaweah River in the Sierra (*20*). He described how "It came racing up the steep chaparral-covered slopes in a broad cataract of flame . . . but as soon as the deep forest was reached the unugovernable flood became calm like a torrent entering a lake, creeping and spreading beneath the trees where the ground was level or sloped gently, slowly nibbling the cake of compressed needles and scales with flames an inch high, rising here and there to a foot or two on dry twigs and clumps of small bushes and brome grass. Only at considerable intervals were fierce bonfires lighted, where heavy branches broken by snow had accumulated, or around some venerable giant whose head had been stricken off by lightning."

Use of fire as a tool by foresters in the ponderosa pine region has been confined largely to the burning of piled slash in selectively logged areas. There is developing a tendency, however, to use less fire and to dispose of only a portion of the slash by piling and burning, largely because of increasing costs and difficulties of obtaining suitable piling. One of the reasons advanced is that slash and other debris should be returned to the soil; this, despite the fact that present soils have developed under conditions of periodic burning extending back many milleniums. In the enlarging slash areas and in other changes caused by the white man this writer sees serious threats to success in ponderosa pine management.

FIG. 3.—Section from a basal "cat face" of a ponderosa pine cut in 1949 near Turkey Creek on the Fort Apache Reservation. Decadal growth rings, marked by dots, were identified by the Tree Ring Laboratory of the University of Arizona. Fire years are identified by the dates.

Changes Caused by the White Man

The writer has already described these changes in considerable detail (*26, 30, 31*). The following points, however, are worthy of particular attention.

Preparation of extensive mineral soil seedbeds through early overgrazing of stock and destruction of the grass sod appears to have been of particular importance in establishment of the dense reproduction stands characteristic of considerable portions of the ponderosa pine forests (*22, 30, 31*). In contrast, under primeval conditions there is evidence that pine seedlings could become established and could survive competition and periodic fires only where clearings had been made in the grass sod, where windthrown tree roots had overturned the soil, or where previous fires had consumed snags or windfalls from insect or lightning deadened trees.

In any event, fire has been excluded from the major portion of these abnormally dense stands from their very inception. On the better sites, good growth is occurring despite crowded stand conditions. On extensive poorer sites, however, a condition of growth stagnation has developed. Thinning to obtain improved growth presents a very serious problem because of cost.

With fire exclusion more tolerant, associate climax species such as white fir, incense-cedar and western larch have captured the ground over extensive areas. With logging of the over-story pines, these areas are almost entirely converted to the climax type (*16*). It has been found also that the dense understory of reproduction competes seriously with the overstory trees for limited soil moisture, thus rendering the latter more susceptible to pine beetle attack. Grass and forage plants can not compete with the dense coniferous reproduction over large areas and carrying capacity for

FIG. 4.—The Malay Gap area of the San Carlos Indian Reservation in Arizona has been swept by periodic surface fires at frequent intervals until recent date. Despite such it is well stocked with sapling and pole-sized reproduction. The last extensive fire of May, 1943, burned completely through this reproduction stand. Photo taken in May, 1950.

FIG. 5.—Forester Harry Kallander indicating a grown over fire scar exposed by chopping. In 1929 this tree was scarred by a fire that covered approximately 12,000 acres of the Maverick area of the Fort Apache Reservation. The area is well stocked by pole stands and groups of poles similar to the group here depicted, that survived the fire. Younger saplings that have since grown in places give the reproduction stands a "two-storied" appearance.

FIG. 6.—This dense reproduction stand on the Colville Indian Reservation in north-central Washington was treated by prescribed burning in October, 1942. Photo taken in early November of the same year. Scorched foliage appears lighter colored in photo.

FIG. 7.—Repeat photo taken in the spring of 1950 of the scene depicted in Figure 6. The 1942 burn reduced the number of stems from 2,430 to 690 per acre. Fire killed stems at the time of this photo had mostly fallen to the ground. Surviving trees are vigorous and have made rapid growth. Photo by *Henry Wershing*.

game and domestic animals has been lessened.

Fire hazard has increased tremendously and is continuing to increase. The dense reproduction stands are, in themselves, highly inflammable. The heavy needle mat that has accumulated, snag and windfall remains of numerous beetle or lightning killed trees and other debris add to the fuel. On extensive areas, already excessive fuel has been added to greatly by undisposed of logging slash, as previously indicated. The writer believes this to be the most threatening and potentially dangerous change that has occurred since early days. During the past several years the Southwest has experienced a series of large, exceedingly destructive fires in ponderosa pine. These fires have been particularly destructive and difficult to control in the slash areas.

Tests of Prescribed Burning

To test possible use of prescribed burning for correction of the above adverse conditions, several areas

of dense ponderosa pine reproduction were burned on the Colville Reservation in the fall of 1942. (Figs. 6 and 7). This burning was conducted during favorable weather periods, from previously prepared fire lines, from which the fires were permitted to burn down the slopes and against the prevailing wind. On and adjacent to one of these areas a number of fifth-acre sample plots, on each of which approximately 20 crop trees were selected, were established to enable contrasting measurements of burned and unburned stands. The Pacific Northwest Forest and Range Experiment Station, from results observed in 1949 (*19*), reports that the burn was effective in reducing number of stems in dense thickets from 2,430 to 690 per acre, but results were not uniform, some patches being thinned too severely and others not enough. During the 6 years then elapsed since burning, crop trees within the burn averaged .25 inches annual diameter growth, while trees in the unburned area averaged .18 inches. It is concluded that the method needs further systematic test and study of results, since it may afford a cheap, quick, wholesale method of obtaining desirable stand improvement. In cooperation with the Station, an additional area was burned on the Colville Reservation in 1952. Reporting on results awaits study and analysis.

FIG. 8.—April 1954 photo of Plot D of the Blue Mountain prescribed burning plots on the Fort Apache Reservation. The burn of October, 1950, reduced heavy fuel by 64 to 80 percent by cubic foot volume. As here depicted stumps, old windfalls and snags were almost entirely consumed by the fire. Hazard has been considerably reduced.

Photo courtesy Henry Wershing, Portland, Oregon.

Subsequent to 1942, during war and post-war years, prescribed burning techniques were applied in conjunction with burning of tractor-piled slash and with spot burning of unpiled slash on the Colville Reservation (*27, 29*). As before, thinning results were spotty, with the greatest portion of the areas being thinned on the conservative side, but reduction in fire hazard has been very pronounced. This is illustrated by analysis of 4 of 90 fires started by dry lightning storms the night of August 15 and 16, 1953. One fire in logging slash was extremely difficult to control before it burned over 582 acres. Cost of control was $6,407 and damage was estimated at $3,805. Another fire on an area logged and slash piled and burned several years ago, but otherwise not intensively cleaned up, was moderately difficult to control and burned 364 acres. Cost of control was $4,590 and damage was estimated at $1,145. Two other fires burned on selectively logged areas given intensive slash burning and prescribed burning treatment during the war years. Ground cover consisted of a good stand of grass and reproduction patches. No action was taken on these fires until the evening of the 16th because of shortage of man-power and urgency of controlling other more dangerous fires. They were easily controlled, one at 113 acres and the other at 100 acres. Combined cost of control was $1,527 and damage was estimated at $391.

Prescribed burning tests were started in dense ponderosa pine sapling and pole stands on cut-over lands of the Fort Apache Indian Reservation in Arizona in the fall of 1948 and fall of 1949. In September and October, 1950, they were continued on six 2.5 acre plots selected at random from twelve that had been established in cooperation with the Southwestern Forest and Range Experiment Station (Fig. 8). Comparative results from burned and unburned plots are still being analyzed and will be reported on by the Station.

In November and December, 1950, approximately 65,000 acres of high hazard ponderosa pine lands

were covered by prescribed burning on the Fort Apache (*29*). Thinning results are similar to those observed in the State of Washington. Hazard reduction has been very pronounced. Lighter fuel of the forest floor was reduced 55 percent by weight and heavy fuel, including snags, windfalls, stumps, etc., by 64 to 80 percent by cubic foot volume. During the years 1948 to 1950 inclusive, preceding treatment, the yearly average of fires occurring per 1,000 acres protected was .620, while the yearly average of number of acres burned per 1,000 acres protected was 10.570. During 1951 to 1953, inclusive, following treatment, the average number of fires occurring was .108 and the average number of acres burned was only .089, a reduction in latter category or over 99 percent. Also during the last three-year period, on the remainder of the protection area, comprising approximately 791,000 acres, the yearly average in number of fires per 1,000 acres was .261, while the average number of acres burned per 1,000 acres was .830, over nine times the average acreage burned per 1,000 acres on the treated area. It should be emphasized that no accelerated soil erosion has been identified as traceable to the prescribed burning. The tests have been continued.

Conclusions

Wildfire is an enemy of forest management. This no one will deny. Before coming of the white man, however, fire was an important ecological factor in several of the most valuable forest types. Study of the past role of fire in these types leads to the conclusion that its use under proper management is still necessary, for instance, in regeneration and maintenance of valuable longleaf pine stands. It is believed that it should also be used under proper control towards correction of adverse conditions in the ponderosa pine forests, where, since earlier days, the white man has caused significant ecological changes, some of which threaten sound management and protection. Prescribed burning tests in these stands have resulted in thinning on the conservative side of dense reproduction stands and in significant reduction in fire hazard, number of fires, damage and cost of suppression. Prescribed burning tests such as described and as now being conducted under the auspices of the School of Forestry of the University of California in ponderosa pine stands in California should be continued, for they are based on sound ecological concepts.

This brief summary barely touches the subject of fire in forest management. It is hoped, however, that it will aid in understanding that fire may be a friend and tool as well as an enemy. Fire under control is one of the most useful servants of civilized man.

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Historical Sketch of U. S. Forest Service Botanical Activity, 1905-1954

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In a broad sense practically all forestry activities are botanical or else have botanical connotations. For purposes of this discussion, however, the word "botanical" in the heading is limited to dendrology and to the taxonomy, nomenclature, ecology, geographic distribution, phenology, and economic values of native range plants. These phases will be covered under two heads: (1) Range plants, and (2) Dendrology. It is apparent, of course, that the areas from which these United States dendrological and range studies and collections are made are enormously diversified so far as soil, climatic and topographic conditions are concerned.

Range Plants

Nearly one-third of the entire area of the United States is rangeland. Range investigations in the United States may be said to have started in a series of "special reports" during the period 1887-1889 made by members of the Botany Division (later Division of Botany, an organization no longer in existence), United States Department of Agriculture, with publications by Dr. George Vasey, Messrs. G. C. Nealley, S. M. Tracy and others on the grasses and other forage plants of the far West.

The United States Forest Service was formed February 1, 1905, by combining the Division of Forestry (sometimes described as "forests without foresters") in the Department of the Interior and the Bureau of Forestry (sometimes described as "foresters without forests") in the Department of Agriculture. A background of growing conservation sentiment in the country, based largely on widespread abuse of both forest and rangeland, led to this action. Among the many steps leading up to the creation of the Forest Service was an article in the *National Geographic Magazine* for December, 1896, by Dr. Frederick V. Coville (1867-1937) under the title "The Sage Plains of Oregon" in which he suggested some possible solutions of the range problem. In the fall of 1897 Dr. Coville was solicited by Commissioner Binger Hermann of the General Land Office to report for him on sheep grazing conditions on the public domain, and the gist of this report is contained in Forest Growth and Sheep Grazing (Division of Forestry Bulletin 15, 1898) wherein recommendations were made on carrying capacity, exclusion of sheep from certain areas, 5-year permits under fee, permittee responsibility for fires, etc. Dr. Coville probably deserves recognition as the true father of range research in the United States.

Grazing on the Public Lands, by Albert F. Potter and F. V. Coville appeared in 1905 as United States Senate Document 189. In that same year the Attorney General of the United States rendered an opinion that the Secretary of Agriculture had legal authority to charge a fee for use or occupation of the then-called "forest reserves" (now national forests). With the initiation of grazing permits and fees for use of national forest range, scientific range management may be said to have begun, and soon thereafter the need of scientific range research became evident. At the suggestion of Dr. Coville the Forest Service in 1907 appointed two technically trained men, James T. Jardine and Arthur W. Sampson, two pioneer figures in the field of scientific range research. In connection with their investigations on the Wallowa National Forest, Oregon, range plant collections were made by these two men in 1907, which, together with some collections by the late G. A. Pearson on the Coconino National Forest, Arizona, related to his silvical studies of ponderosa pine, constituted the first extensive botanical collections on national forests. In 1908, Will C. Clos, an active amateur botanist and a bishop of the Mormon church, who served as a Forest Service inspector of grazing from 1906 to 1910, made some plant collections on the Manti National Forest, Utah, in company with Mr. Ivar Tidestrom, then a botanist of the Bureau of Plant Industry. All these early collections were deposited in the United States National Herbarium.

In 1910 an office of Grazing Studies (now the Division of Range Research) was set up in the then Branch of Grazing (now the Division of Range Management), with Mr. James T. Jardine in charge. In this office of Grazing Studies a section of Range Forage Investigations was organized in 1911 with the writer in charge. At that time a Forest Service range plant herbarium was begun in the Washington, D. C., office, with smaller herbaria at the headquarters of various regional foresters, forest and range experiment station directors, forest supervisors, and other field offices. Serial numbers were started for all specimens submitted from the field and, for many years, typed (and later photostated) notes were submitted to the field with the lists of identifications for the plants submitted. Emphasis was placed on careful annotation so that the specimens, in addition to their value for identification purposes and for authentifying distribution, would also form a mine of information along ecological, phenological, life-history, and economic lines—particularly as to their value for various classes of domestic livestock and for wildlife. This herbarium, now under the curatorship of Miss Doris W. Hayes, consists of about 110,000 specimens, largely from the rangelands of the eleven far western states, but now covering rangelands in other states, particularly the Southeast. These specimens are the product of probably at least 1,500 administrative and research personnel, collected in connection with administrative or investigative work. Most of these collectors would doubtless be described by Linnaeus as "tirones"; none are

professional collectors, performing this service as a sideline to other work, yet a very appreciable number have done collecting of professional caliber, among the more outstanding of whom was the late Douglas C. Ingram, who perished in the forest fire of August 1929 on the Chelan National Forest, Washington. *Silene ingramii* was named in his honor. The late Prof. Albert S. Hitchcock (1865-1935), a world traveler of wide experience, once told me that he had never met a more competent botanical guide than Ingram.

It is apparent that familiarity with the vegetation which produces the range forage crop is essential to efficient rangeland management. Most of the phases of range management are intimately associated with a knowledge of the range plants, their life history and requirements, and their value for different classes of domestic livestock and wildlife. For example, in determining the class of livestock to which a range is best suited the character of the forage is the first factor to be considered. In deciding grazing periods the permanent welfare of the range is the fundamental principle. To know whether the range is improving, stationary or deteriorating; whether key plants are handicapped in the production of a viable seed crop or are being utilized at periods of maximum palatability are among the pertinent questions that demand for their proper answers acquaintance with the plants themselves. Earmarks of overgrazing and undergrazing, need for fencing and salting, injuries to timber reproduction, and livestock poisoning are among other phases of rangeland management that tie-in closely with knowledge of range plants.

For many years the Forest Service Herbarium was probably the most outstanding plant collection for the remoter parts of the West and has been consulted by many botanists, both American and foreign. The late Dr. Per A. Rydberg told me that he got more range extensions for his *Flora of the Rocky Mountains* from this herbarium and its distribution lists than from all his other sources combined. Over a hundred new species have been published from these collections, the types being deposited in the United States National Herbarium, although we have many isotypes. It is undoubtedly the most fully annotated collection of its kind in the United States.

The collection includes upwards of 1,500 plants from Alaska. In 1922 Mrs. J. C. Dort accompanied her husband, a Forest Service engineer, on a trip to the Tongass National Forest, southeastern Alaska. There she collected about 150 plant specimens, one set of which was deposited in the Forest Service Herbarium. Since then our chief collectors in Alaska have been former Regional Forester Charles H. Flory, Prof. H. J. Lutz of the Yale University Forest School on summer details to the Forest Service, and Dr. Raymond F. Taylor, in charge of the Forest Service Alaska Research Center at Juneau.

Besides advice and technical assistance to administrative and research personnel of the Forest Service, to other outside agencies and to the general public, members of this unit have published well over a hundred minor papers and many data are still unpublished. Some of the larger publications, aside from numerous contributions to the 1948 Department of Agriculture Yearbook "Grass," are:

Notes on National Forest Range Plants—Part I. Grasses, by Dayton and W. R. Chapline. 224 p. U. S. Forest Service, 1914.

Important Western Browse Plants, by Dayton. U. S. Dept. Agr. Misc. Pub. 101, 214 p., illus. 1931.

Artificial Reseeding on Western Mountain Range Lands, by Clarence L. Forsling & Dayton. U. S. Dept. Agr. Circ. 178, 48 p., illus. 1931.

Glossary of Botanical Terms Commonly Used in Range Research, by Dayton. U. S. Dept. Agr. Misc. Pub. 110, 40 p., illus. 1931. Slightly "revised" in 1950 by the addition of 17 terms.

Range Plant Handbook, by a group of people, mostly field men under the direction of Dayton. 867 p., illus. 1937.

Standardized Plant Names, Ed. 2. By Harlan P. Kelsey and Dayton. 675 p. J. Horace McFarland Co., Harrisburg, Penna. 1942. In this work Dayton represented the U. S. Department of Agriculture.

The late Dr. Miriam L. Bombard (1898-1952)—see obituary sketch in *Taxon* 2:133-134, 1953—an authority on the ecology and taxonomy of Louisiana plants, issued, in collaboration with O. Gordon Langdon and John T. Cassady, a *Field Book of Forage Plants on Longleaf Pine-Bluestem Ranges* (So. For. Expt. Sta. Occas. Paper 127, 117 p., illus. 1952).

Dendrology

Mr. George Bishop Sudworth (1864-1927), an international figure in the field of dendrology, served as botanist and later as dendrologist in the Division (later Bureau) of Forestry, United States Department of Agriculture, from 1886 to 1905. With the creation of the Forest Service in 1905 he became chief dendrologist of that Service, a position occupied by him until his death. Among his better-known publications are his reports (1898-1900) on the Battlement Mesa, Lake Tahoe, Stanislaus and White River Plateau Forest Reserves; his *Forestry Nursery: Collection of Tree Seeds and Propagation of Seedlings* (1900); his three checklists: *Nomenclature of the Arborescent Flora of the United States* (1897) and *Check List of the Forest Trees of the United States, their Names and Ranges* (1898), the latter extensively revised in 1927; *Forest Trees of the Pacific Slope* (1908), and the series of Rocky Mountain tree bulletins: *The Cypress and Juniper Trees of the Rocky Mountain Region* (1915), *The Spruce and Balsam Fir Trees of the Rocky Mountain Region* (1916), *The Pine Trees of the Rocky Mountains* (1917), and *Miscellaneous Conifers of the Rocky Mountain Region* (1918). Some time after Mr. Sudworth's death an incompleted manuscript was

found among his papers and this was turned over to the writer for editing and completion; this appeared in 1934 as *Poplars, Principal Tree Willows and Walnuts of the Rocky Mountain Region* (United States Department of Agriculture Technical Bulletin 420).

Sudworth was a member of the committee which drafted the now obsolete American Rules of plant nomenclature. He had a large tree herbarium, which the Forest Service turned over to the United States National Herbarium and various forest school herbaria on his death. The position of denrologist in the Forest Service remained vacant for 15 years, until 1942, when the Division of Dendrology and Range Forage Investigations was set up in the Branch of Research, with the writer as chief and Dr. Elbert L. Little, Jr., as dendrologist. Since then effort has been made to build up, primarily for identification and distribution purposes, the tree phases of the Forest Service Herbarium in Washington.

In 1943 Dr. Little and myself participated in the forest survey parties sent to Costa Rica and Ecuador. Dayton was a joint-author of the two Costa Rica illustrated reports issued in November, 1943, *The Forests of Costa Rica* and *Accomplishments of Latin American Forest Resources Project in Costa Rica*. Little was a joint-author of the Ecuador report, published in 1947, *The Forests of Western and Central Ecuador*. Little's *Check List of Native and Naturalized Trees of the United States (including Alaska)* (United States Department of Agriculture Handbook 41, 472 pages, which appeared in 1953) was preceded in 1944 by a preliminary mimeographed edition. The personnel of the division contributed to the United States Department of Agriculture Yearbook for 1949, *Trees*, especially Little's *Important Forest Trees of the United States* (pages 763-814) and *Fifty Trees from Foreign Lands* (pages 815-832). In 1950 Little published *Southwestern Trees: A Guide to the Native Species of New Mexico and Arizona* (109 pages) and, the same year, in collaboration with Raymond F. Taylor, the 63-page handbook *Pocket Guide to Alaska Trees*. Many smaller publications have been issued, including several papers by Little on plant nomenclature, *New Species of Trees from Western Ecuador* (Washington Academy of Sciences Journal 38: 87-105, illustrated, 1948), and some papers (jointly with Keith W. Dorman) on a new Florida variety of slash pine. Dayton has published, *inter alia*, papers on Kelsey locust, the names of the giant sequoia, a 32-page bibliography of United States tree books, and *Seven Small Plant Collections in Costa Rica and Neighboring Panama* (Phytologia 4:223-265, illustrated. 1953). The late Dr. Miriam L. Bomhard, in 1950, issued *Palm Trees in the United States* (Agricultural Information Bulletin 22), and previously had published papers on palm oils and waxes, on the wax palms of the Andes, and on palms cultivated in Louisiana.

SOCIETY OF AMERICAN FORESTERS

55TH ANNUAL MEETING

Portland, Oregon — Multnomah Hotel

October 16-19, 1955

See pages 528-531 for information concerning the schedule of events, hotel reservations, and committees for the meeting.

Tree Growth, Action and Interaction of Soil and Other Factors[1]

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THERE are remarkable differences in growth characteristics of forest tree species. In New England some of these differences have been elucidated by the researches of Baldwin (*1*), Kienholz (*9*), and others. Kienholz found that in this region deciduous species may be divided into two groups. In the first group, height growth accelerates rapidly to a late May climax in Connecticut and falls off to zero by late June. The whole growth period lasts about 60 days. Of this growth, 90 percent occurs in a 30-day period which begins one or two weeks after growth starts. Included here are maples, red oak, white ash, and beech; and white, red, scotch and jack pine among the conifers. In the second group growth begins at about the same time but does not accelerate as fast. The climax for this group is reached in Connecticut in mid-June and falls off to zero by mid-August. Ninety percent of this group's growth takes place in a 60-day period beginning 3 to 4 weeks after growth starts. Characteristic species include grey and white birch, yellow-poplar and the aspens. Generally similar growth patterns for New York State have been described by Cook (*6*).

Kramer has compared Kienholz's growth curves for white and red pine in New Hampshire with his own data for the same species in North Carolina (*14*). Perhaps the most significant feature of this comparison is the fact that the severe change in environment that resulted from transferring white and red pine from New England to North Carolina merely increased the absolute lengths of their growing seasons but did not change the relative lengths nor the shapes of their growth curves. Apparently the length of growing season and shape of the growth curve of a particular species are controlled more by hereditary factors than by environment.

Another salient feature of tree growth is the relatively small part of the frost-free season that is devoted to height growth. Illick's data for Pennsylvania indicated that at Mont Alto about 90 percent of all shoot growth occurred in the first quarter of the frost-free season (*7*). Kramer reported that in Durham, North Carolina, trees made 90 percent of their growth in half the frost-free season (*14*) and Kienholz reported similarly for New England (*9*). A few species, however, utilize most of the frost-free season.

Diameter growth usually begins much later and lasts longer than does height growth. Cambial division often starts after leaves are from one-half to fully formed. Often there is earlier inception of cambial activity in ring porous than in diffuse porous species. Differences in height and diameter growth characteristics have been studied by Reimer in Indiana (*20*) and Kienholz in New England (*8*).

During growth cycles trees manifest certain internal seasonal rhythms. Typical seasonal correlations may be found in cambial growth, accumulation of carbohydrates, water content of wood, and osmotic pressure of cortical cells.

Following a winter dormancy the cambium is reactivated by an expansion of cambial cells in the radial direction and by initiation of cell division. Radial enlargement is accompanied by weakening of cell walls. Cambial reactivation is often related to transfer downward of growth substances from developing buds. Thus a cambial growth wave migrates basipetally toward the trunk and finally the roots. It has been shown that 9 to 10 weeks may elapse in some species between the beginning of xylem differentiation in the twigs and that in the roots (*5*).

Carbohydrate reserves fluctuate and are markedly depleted by demands of height growth and leafing out in the spring. Starch reserves are at a minimum in early summer and build up to an autumn peak which gradually declines during the winter. The bark shows more violent fluctuation than does the wood (*21*).

Water content of wood fluctuates seasonally and appears to be well correlated with the growth cycle. Water content of poplar and birch has been shown to decrease rapidly during the growing season and reach a late summer minimum. It increased during autumn and early winter and, after a slight decline during the coldest part of the winter, reached a spring maximum that coincided with beginning of growth (*21*). Conifers exhibit much less seasonal fluctuation in water content than do hardwoods.

The discussion this far has alluded to starch reserves only. Actually soluble carbohydrates are often present in some tissues in much greater quantity than is starch. A general pattern of spring depletion of total carbohydrates in the living bark of black locust has been demonstrated. Available data indicate that sucrose is the principal carbohydrate present in the bark of black locust and starch is a poor second. Both are depleted in the late spring by the vernal flush of growth. Shortly thereafter sucrose accumulates and reaches a maximum in late summer. Starch does not appear as a significant storage product until late summer and reaches an early fall maximum. While starch disappears with advent of cold weather in late fall, sucrose is retained in high concentration throughout the winter. With advent of warm weather in early spring and prior to initiation of growth, sucrose is apparently converted to starch and such transformation occurs only when the temperature has a minimum above 0° C.

Reducing sugars are present in low amounts throughout the year,

[1]Paper presented at a meeting of the New England Section, Society of American Foresters, Boston, Mass., March 11, 1954.

reaching a late winter maximum. It appears that a temperature sensitive and reversible enzymatic process is operational in this metabolic picture (*22*).

Behavior differences between species emphasize the unchangeable nature of hereditary limitations on growth. Changes in environmental factors produce growth variations, only within limits imposed by hereditary potentialities, by changing internal physicochemical processes and conditions of a tree. Failure of trees to grow and survive is basically the result of some disruption of the balance and coordination in rates of physiological processes. In the last analysis growth may be viewed as a manifestation of the rates by which certain anabolic processes exceed catabolic ones. Since carbohydrates compose over three-fourths of the dry weight of woody plants, tree growth is closely correlated with production of photosynthate.

The seasonal rhythms in carbohydrate metabolism that have been emphasized must not obscure the most crucial consideration that the quantitative amount of carbohydrate produced a given year will profoundly affect height growth of trees during the following year and diameter growth the same year. Shoot growth of trees is generally considered to be made at the expense of stored carbohydrate rather than current year photosynthate (*14*). Any environmental factor that alone or in combination influences carbohydrate production will determine a tree's ability to begin rapid growth the following year and the amount of height growth it will make.

Influence of Soil Factors

Soil moisture is often one of the most critical factors of the edaphic complex. Water is important as a constituent of living protoplasm, a reagent in chemical reactions, a medium in which reactions occur, and a solvent. It is also very important in the maintenance of leaf turgidity. Wilted or partially wilted leaves are ineffective photosynthetic mechanisms.

Claims were made for many years that all the soil moisture in the range from field capacity to wilting percentage was equally available to trees. It was repeatedly stressed that there would be no physiological advantage in irrigating trees before soil reached the wilting percentage. There are many observations, however, which indicate that physiological processes are profoundly influenced by drying soil and that very real effects on metabolism and growth are manifested some time before the soil reaches the wilting percentage.

Disagreement over the degree of availability of water in drying soil partly exists because of differences in moisture tension-moisture content relations for different textural grades of soil. In coarse-textured soils the moisture tension changes relatively little from field capacity almost down to the wilting percentage and at that point changes rather precipitously to permanent wilting percentage. Moisture tension-moisture content curves for finer textural grades of soil do not exhibit such a sharp break and indicate that water is withheld from plants with appreciably greater energy over the lower part of the available range than over the upper part. In terms of energy relationships the water in such soils becomes gradually less available as the moisture content decreases from field capacity to wilting percentage (*15*).

When simultaneous measurements were made of soil moisture content and photosynthesis it was found that photosynthetic rates of leaves of a conifer and hardwood were significantly depressed long before the wilting percentage of the soil in which they were rooted was approached (*3, 11*). Loustalot's data further corroborate these findings and show furthermore that once photosynthesis was depressed by a severe water deficit, replenishing the soil water to field capacity did not bring about an immediate photosynthetic response. Seven days after water was replenished photosynthesis had recovered to only 60 percent of its prior efficiency (*19*).

Work in our laboratory has shown consistent and marked depletion in carbohydrate reserves of roots, stems, and leaves (including starch, reducing sugars, and nonreducing sugars) of plants in soil that was allowed to dry down but not reach the wilting percentage. These data stress the importance of available water in the upper levels of the range between field capacity and wilting percentage in certain textural grades of soil.

The area of soil fertility has too many ramifications to begin to be adequately considered at this time. Mineral elements enter into the structure of protoplasm and cell wall material. Deficiency of elements like magnesium and nitrogen which become part of the chlorophyll molecule may often effect a degree of chlorosis that profoundly influences photosynthetic rates and therefore growth. Some elements like iron have important catalytic effects in chlorophyll synthesis. Available nutrients also influence osmotic pressures of cells, acidity and buffer action, hydration of cell colloids, permeability of membranes, etc. Since not much can be done about fertility levels over wide areas of forest land, a recognition of minimum nutrient requirements is of considerable importance in selection of species and planting sites. Wilde has broadly evaluated minimum nutrient requirements for forest trees (*23*). Under certain conditions nutrient excess may promote abnormal development by interference with metabolism. Deterioration of trees on soils with abnormally high content of soluble nitrogen is an example.

Wilde has also evaluated planting site requirements of representative conifers and deciduous species in terms of minimum contents of silt and clay particles, reaction, and minimum content of organic matter in the upper seven inches of soil (*23*).

Soil temperature alone and in interaction with climatic factors influences tree growth. Near freezing soil temperatures usually stop root elongation of many species but roots of species native to warm

climates cease growth at higher temperatures than do cool-climate species. High soil temperatures often limit root growth and temperatures of soil surfaces exposed to the sun are often high enough to injure roots and stem bases (*15*).

Low soil temperatures often exert indirect effects on growth by influencing water uptake. When typical absorption-transpiration curves for trees and herbaceous plants are examined a diurnal fluctuation is evident in which transpiration exceeds absorption during the daytime while absorption exceeds transiration during the night. This means that moisture content of leaves on a normal day is higher at night than during midafternoon. If the discrepancy between absorption-transpiration curves is great enough, leaves become desiccated and the rate of photosynthesis is markedly reduced.

In conifers a common type of winter injury may occur when the soil is frozen and therefore absorption of water is negligible. During the afternoon of such a winter day the air above ground may warm up sufficiently so that considerable transpiration occurs while the frozen soil precludes replacement of lost moisture. This results in leaf burn of conifers and is a common type of winter injury caused by an interaction of climatic and soil factors affecting two processes differently which should proceed at the same rate in order to prevent leaf desiccation. Low soil temperatures reduce water absorption by retarding root growth, decreasing the rate of water movement from soil to roots, decreasing permeability of cells, increasing viscosity of protoplasm, decreasing vapor pressure of water, and decreasing metabolic activities of living root tissues (*15*).

It should be re-emphasized that one of the most fascinating facts about tree growth is that the manner in which efficiency of physiological processes is affected in any environment varies with species. As an example, white pine is much more efficient in absorbing water at low soil temperatures than is loblolly pine (*10, 13*). These species differences may play a significant part in restricting species ranges.

Soil aeration has considerable influence on functioning of roots. Tolerances of trees to poor aeration vary widely and natural selection eliminates unsuitable trees. If, however, more were known about the precise responses of competing species to poor aeration, the choice of species for planting would be appropriately influenced. Vigorous root growth requires carbohydrates and hormones from the crown and suitable conditions of aeration moisture, minerals, and temperature below ground.

Respiration of tree roots must be maintained at a particular level in harmony with the photosynthetic rate of the crown. Some of the energy released in respiration is used in other activities, such as mineral uptake.

The oxygen content of soils decreases with depth and may go down to a fraction of 1 percent at a 5 foot depth (*16*). Carbon dioxide concentration may build up to an abnormally high level in the soil so that tissues will not function normally in this environment. The soil atmosphere is often completely different in gaseous composition from that above ground.

It is believed by some physiologists that part of the injury to tops of trees in flooded soil is caused by toxic substances that are produced in the soil or in the dying roots themselves and are translocated to the tops from these roots (*17*). The effects of wet sites on root respiration need to be more precisely evaluated.

Reduced soil aeration may force roots to change from aerobic to anaerobic respiration with a consequent accumulation of toxic by-products. In addition to carbon dioxide and ethyl alcohol a number of fermentation and decomposition products may be formed. Poor aeration also affects some species by decreasing permeability of cell membranes, reducing absorption of water and minerals, reducing transpiration, discoloring foliage, decreasing carbohydrates, delaying and suppressing reproductive processes, and decreasing nitrification. Poor aeration often results in shallow rooted species.

Other important soil factors that play a significant role in tree growth but cannot be considered in this brief discussion include texture, structure, pH, slope, base exchange properties, organic matter, organisms, etc.

Interactions of the Environmental Complex

As a tree is subjected to rapid changes in climatic environmental factors, it may also be subjected to severe fluctuations in soil temperature, soil water, aeration, etc. Any of these factor fluctuations may impose an effect on one part of the tree which is transmitted to another part and changes the effect of or importance of some other factor acting at that point. To illustrate these combined and interacting effects may I refer to a situation in the Piedmont plateau where the difficulty of regenerating pine stands is a serious forestry problem. Somewhat analogous successional problems exist in New England. In the Piedmont the natural succession is from pine communities to climax, hardwood types. Cutting of pine releases understory hardwoods which then outgrow pine seedlings. Pine stands are readily established on open fields, however, and in 10 or 15 years closed pine stands are established. The understory of such young stands is composed of hardwoods, and pine thins out as it reaches overmaturity in 70 or 80 years. When the effects of light intensity on photosynthetic efficiency of pine and hardwood seedlings were studied it was found that photosynthesis of pine increased progressively with light intensity up to the highest light intensities. Hardwoods, however, reached a maximum at one-third or less of full sunlight (*18*). In addition it was shown that the hardwoods had an inherent capacity for greater quantitative production of photosynthate. Furthermore with decreasing soil moisture content the photosynthetic rate of pine decreased at a higher moisture content than did the rate of the

hardwoods (*11*). Pine also had much smaller root systems than the hardwoods even in the absence of competition (*11, 12*).

Profound effects on photosynthesis of pine were exerted by less than optimum soil moisture and less than full light intensity. Its physiological balance was easily disturbed by decreased light intensity when soil moisture was adequate or by drought when light was adequate. At any instant either of these factors could be the "trigger" factor which exerts the greatest inhibitory effect and often sets off a chain-like reaction. Even under extreme drought conditions, however, the contributing effect of prior exposure to reduced light intensity cannot be overlooked in terms of the total effect, since it previously so conditioned seedlings over a longer period of time as to render them more susceptible to drought. With a better root system, such as would have been produced by growth in optimum light intensity, seedlings could survive more severe droughts.

In evaluating factors of competition, emphasis should be placed on hereditary limitations imposed on the species involved, especially with regard to root and shoot development. A complex of environmental factors including climatic, soil, and biotic factors exerts a continuing impress on growth. There is a shifting and an interplay between environmental factors. Under natural conditions these effects are interacting and interdependent. Ultimate growth is a function of the combined effects of the environmental complex but under certain conditions, and often for a limited time, one or more factors may suddenly become very critical and set in motion a series of metabolic disturbances that will alter the relative contributions of other environmental factors. Cain, a leading American ecologist, has stated that physiological processes are multiconditioned. He does not believe that it is possible to speak of a single condition of a factor as being the cause of an observed effect in an organism (*4*). Billings has recently considered the complexity of the relationships between the tree and its environment and between the various factors of the environment. His thoughtful representation indicates the many reciprocal effects that exist and render difficult an analysis and synthesis of growth and factors controlling it (*2*).

Since many environmental factors cannot be manipulated silviculturally, a question may be raised about need for understanding their precise effects. Silvicultural research is of necessity slow because of the slow rate of tree growth. Since much time is involved in growing a single generation of trees it seems imperative to know as much as possible about the physiological characteristics of tree species and chances of probable success in a given environment before they are tried out in long term silvicultural experiments. It has been demonstrated that species tolerances to individual factors of the environment vary markedly. The intelligent use of such information in the planning stage will be of inestimable value in enhancing progress in silviculture. Many basic processes can be observed in seedlings as well as mature trees. Derivation of more fundamental information about environmental effects on efficiency and quantitative rates of physiological processes under controlled conditions will build up a body of knowledge that will provide a keen insight to better understanding and solution of silvicultural problems.

Summary

Marked differences in growth characteristics of forest tree species exist which indicate that the length of growing season and shape of growth curves are controlled more by hereditary factors than by environment.

Height growth of trees is completed in many areas during only a relatively small part of the frost-free season. For individual species diameter growth begins later and lasts longer than does height growth.

Growth cycles and seasonal rhythms in diameter growth, carbohydrate content, and water content of wood have been demonstrated.

Changes in environmental factors influence growth, only within limits imposed by hereditary potentialities, by affecting internal physiological processes and conditions of a tree.

The roles of soil water, aeration, fertility, and temperature are evaluated briefly in terms of their effects on production of photosynthate and ultimately on growth. Efficiency of physiological processes varies with species under fluctuations of environmental factors.

A complex of environmental factors, including climatic, soil, and biotic factors, affects tree growth. The effects are interacting, interdependent, and reciprocal.

More fundamental information about the role of environmental effects on efficiency and quantitative rates of physiological processes of forest trees is needed for solution of silvicultural problems.

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Underplanted Loblolly Pine Responds to Delayed Release

Release from overstory competition, even when postponed for as long as 8 years, greatly stimulates the growth of underplanted loblolly pine (*Pinus taeda* L.).

In October 1948, the Southern Forest Experiment Station released some loblolly pines that had been planted in 1941 under a low-grade stand of ridge hardwoods in north Mississippi. The hardwood stand was composed mostly of blackjack oak (*Quercus marilandica* Muenchh.) and post oak (*Q. stellata* Wangenh.). It averaged 59.1 square feet of basal area per acre in trees larger than 0.5 inch in d.b.h. The total number of hardwoods per acre was 228; of these, 138 were larger than 3.5 inches d.b.h.

The pines had been planted at an average rate of 1,200 per acre. About 52 percent were still alive in 1948. They averaged about an inch in diameter and 10 feet in height, and their vigor was low. The 100 tallest pines per acre were about 2 inches in d.b.h. and 15 feet tall. Local old-field plantations, at 8 years, generally average 3 inches in diameter and 20 feet in height, with 70 to 80 percent survival.

Details of the hardwood treatments and the growth response for the first 2 years after treatment have already been published.[1] In brief, the study consisted of nine ¾-acre plots. On three the hardwoods were dosed with Ammate and on three they were felled or girdled. All overstory hardwoods above 0.5 inch d.b.h. were treated; those that recovered were girdled later, so that in 1953 the pines were entirely free of overhead competition. The final three plots were left untreated, as checks.

Pine growth was measured on ¼-acre plots inside the larger ones. In terms of pine response, felling or girdling the hardwoods seemed just as effective as using Ammate, hence pine data for both methods were averaged.

Growth and Mortality

During the 5 growing seasons between October 1948 and October 1953, the average d.b.h. of the released pines increased from 1.1 to 3.3 inches—a gain of 2.2 inches or 200 percent. Unreleased pines grew 1.2 inches. The 100 tallest pines per acre grew 2.8 inches where released and 1.4 inches where unreleased.

The basal area increases were even more apparent. Released pines went from a basal area of 6.1 square feet per acre in 1948 to 38.3 feet in 1953. Unreleased pines increased from 6.2 to 17.6 feet.

In height growth the proportionate increase was less great. Released pines grew 11.1 feet in five years, unreleased pines 7.5 feet. The tallest per acre grew 12.6 feet where released and 9.8 where unreleased.

Tested by analysis of variance, all differences in growth between released and unreleased pines are significant or highly significant.

Falling branches, tops, or trunks of the deadened overstory killed or severely injured 8 percent of the released pines. Another 4 percent succumbed to other causes. Total mortality, therefore, was 12 percent. On the unreleased plots, suppression and competition killed 10 percent of the pines. The difference in total mortality between the released and the unreleased stands was not significant.

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[1] Huckenpahler, B. J. Poisoning versus girdling to release underplanted pines in north Mississippi. Jour. Forestry 52:266-268. 1954.

Timber Harvests Help Offset Forage Decline in Missouri's Managed Forests

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Robert L. Dunkeson, and
Thomas S. Baskett[1]

THOUSANDS of deer and range cattle graze part of the time on the national forests and other managed forest land in the Missouri Ozarks. The primary management objective on this land is to increase timber production. The first step toward this end has been to reduce woods burning. Where burning has been prevented for several years, the density of the forest stands has increased and the density and yields of forage plants have decreased. However, the general forage decline in protected and managed forests has been partially offset by herbage increases in openings created by harvesting merchantable trees and killing cull trees. Forage production in such openings may be as much as 40 times greater than in dense timber stands (Fig. 1). Although the forage in forest openings is considered beneficial for cattle (*4, 6, 7*) and is reported to be beneficial for deer (*1, 2, 3*), detailed analyses of the species composition in these openings have not been previously reported.

[1]Authors represent the Central States Forest Experiment Station, the Missouri Conservation Commission, and the Missouri Cooperative Wildlife Research Unit. The authors are indebted to Leon W. Hornkohl, U. S. Forest Service, Rolla, Missouri, and to Dr. Paul D. Dalke, Fish and Wildlife Service, Moscow, Idaho, for laying the groundwork for the study.

Where the Study was Made

This report is based on a study of forage plants on a 1947 timber-sale area in Oregon County. The data were taken on a site that represents thousands of acres of Ozark forest land. Most of the area is gently rolling, but slopes along the watercourses are steep. The soils are rocky, light in color, and low in mineral nutrients. White oak (*Quercus alba*) and black oak (*Q. velutina*) are the most important commercial trees, but scarlet oak (*Q. coccinea*), post oak (*Q. stellata*), blackjack oak (*Q. marilandica*), and hickory (*Carya* spp.) are common. There is some shortleaf pine (*Pinus echinata*). Tree reproduction is sparse except in patches where there are no large overstory trees.

The virgin pine was harvested from this area about 1900. Fires were frequent, and cattle and hogs ranged unrestricted until about 1935 when the area was made part of the Clark National Forest. Since then fire has been kept out and grazing has been light to moderate. Although cattle and hogs have gradually decreased in number since 1935, deer have increased. All merchantable white oaks larger than 16 inches d.b.h. were cut in 1947. By 1950, forage plants were noticeably more numerous, taller, and more vigorous in the released areas around the stumps than in unreleased areas around standing trees.

How Effects of Release Were Studied

The frequency and species composition of forage plants in openings were compared with those under a forest canopy on 12 pairs of sample areas. Twelve of the areas were centered around large live trees and the other 12 around large 3-year-old stumps. Seventy-five circular 1-square-foot plots were located in each sample area. The plots were located at 2-foot intervals along three 50-foot lines radiating from the tree or stump at the center of the sample area.

The vegetation record for each 1-square-foot plot was a list of the species that occurred on it. In summaries where two or more species are grouped, the combined frequencies of the individual species are expressed as "the average number of species per plot" (Table 1).

Crown cover of all trees more than 10 feet tall was used as the measure of overstory influence. The presence of crown cover was recorded if one or more tree crowns overhung a plot.

The classes of forage plants recorded were browse, grasses, and

FIG. 1.—*Left.* This small woods opening is growing green herbage at the rate of 450 pounds per acre. *Right.* This fully stocked black oak stand nearby is producing only 12 pounds of green herbage per acre.

TABLE 1.—EFFECTS OF RELEASE ON FREQUENCY AND COMPOSITION OF FORAGE

Class of vegetation	Average number of species per plot			Forage composition	
	Unreleased plots	Released plots	Increase	Unreleased plots	Released plots
	Number	*Number*	*Number*	*Percent*	*Percent*
Browse	0.23	0.32	0.09	14	14
Grasses	.36	.68	.32	21	28
Forbs	1.14	1.41	.27	65	58
Total	1.73	2.41	0.68	100	100

TABLE 2.—LIST OF SPECIES[1]

Overstory trees	
Black oak	*Quercus velutina* Lam.
Blackjack oak	*Quercus marilandica* Muenchh.
Post oak	*Quercus stellata* Wangenh.
Scarlet oak	*Quercus coccinea* Muenchh.
White oak	*Quercus alba* L.
Hickory	*Carya* spp.
Shortleaf pine	*Pinus echinata* Mill.
Browse[2]	
Blueberry	*Vaccinium* spp.
Bramble	*Rubus* spp.
Dogwood	*Cornus* spp.
Dwarf sumac	*Rhus copallina* L.
Grape	*Vitis* spp.
Greenbrier	*Smilax* spp.
Black gum	*Nyssa sylvatica* Marsh.
New Jersey tea	*Ceanothus americanus* L.
Rose	*Rosa* spp.
Sassafras	*Sassafras albidum* (Nutt.) Nees
Grasses and sedges	
Big bluestem	*Andropogon Gerardi* Vitman
Broomsedge	*Andropogon virginicus* L.
Little bluestem	*Andropogon scoparius* Michx.
Indiangrass	*Sorghastrum nutans* (L.) Nash
Lovegrass	*Eragrostis* spp.
Panic grass	*Panicum* spp.
Poverty oatgrass	*Danthonia spicata* (L.) Beauv.
Sedge	*Carex* spp.
Three-awn	*Aristida* spp.
Forbs	
Tick clovers	*Desmodium* spp.
Bush lespedezas	Mainly *Lespedeza virginica* (L.) Britt. and *L. violacea* (L.) Pers.
Vine lespedezas	Mainly *Lespedeza procumbens* Michx. and *L. repens* (L.) Bart.
False indigo	*Baptisia leucophaea* Nutt.
Goat's rue	*Tephrosia virginiana* (L.) Pers.
Pencil flower	*Stylosanthes biflora* (L.) BSP.
Wild beans	Mainly *Strophostyles, Amphicarpa,* and *Galactia*
Asters	*Aster* spp.
Cudweed	*Gnaphalium* spp.
Feverfew	*Parthenium integrifolium* L.
Goldenrod	*Solidago* spp.
Hawkweed	*Hieracium Gronovii* L.
Pussy's toes	*Antennaria plantaginifolia* (L.) Hook.
Prickly lettuce	*Lactuca floridana* (L.) Gaertn.
Tickseed	*Bidens* spp.
Woods sunflower	*Helianthus strumosus* L.
Cinquefoil	*Potentilla simplex* Michx.
Bracken fern	*Pteridium aquilinum* (L.) Kuhn
Bradbury mint	*Monarda Bradburiana* Beck
Dittany	*Cunila origanoides* (L.) Britt.
Flowering spurge	*Euphorbia corollata* L.
Phlox	*Phlox* spp.
St. Johnswort	*Hypericum punctatum* Lam.
Violet	*Viola* spp.
Dogbane	*Apocynum* spp.

[1]Nomenclature is that of "Gray's Manual of Botany" 8th edition, 1950, by M. L. Fernald.

[2]Browse also includes small trees and foliage of overstory species that hangs less than 5 feet from ground.

forbs. A list of species recorded is shown in Table 2. Browse was included if it overhung the plot and hung less than 5 feet from the ground. Grasses and forbs were recorded only if the plants were rooted within the plot.

At low frequencies the relationship between frequency and abundance is a very gradual curve and frequency is a good indicator of abundance (*5*). Since the frequencies of forage plants on the study area were low, it is assumed that frequency and abundance are closely related. In subsequent discussion, all expressions of differences in amount, number, or abundance of vegetation are based on frequency data.

Release Increased all Classes of Forage

On all areas the frequency of forage plants was related inversely to crown cover (Fig. 2). As would be expected, the differences between the released and unreleased plots were greatest near the central tree or stump. Since data were sufficient to show only large differences, subsequent analysis was confined to data taken within 25 feet of the trees and stumps that marked the centers of the sample areas.

Cutting overstory trees increased the frequency of forage plants by 39 percent, but all classes of forage plants did not respond to the same degree. Overstory release increased browse by 39 percent, grasses by 89 percent, and forbs by 24 percent. The main effect of release was to increase the percentage of grasses and decrease the percentage of forbs (Table 1).

"Good" Species Accounted for All Browse Increase

In this study, browse included low-hanging tree foliage as well as that of the more palatable vines and shrubs. Desirable browse plants (*1*). mostly shrubs and vines, were 98 percent more numerous on released plots and accounted for all the browse increase. Blueberry, the most abundant browse species, accounted for almost one-third of the browse on both unre-

leased and released plots. Other desirable browse plants that obviously benefitted by release were brambles, dwarf sumac, New Jersey tea, and grape. The amount of accessible foliage of the oaks, hickory, and other common trees, considered to be poor browse, was affected little by release. Oak foliage was the most abundant class of poor browse. Since desirable browse plants made up all of the browse increase on released plots, it is apparent that cutting the overstory trees increased the amount of usable browse.

Grasses Showed Greatest Response to Release

Perennial grasses made up one-fourth of the herbaceous plants (grasses and forbs) on unreleased plots and one-third of the herbaceous plants on released plots. Moreover, they accounted for almost half of the increase in herbaceous plants on released plots. All grasses on the plots were perennials. Occasional annual panic grasses, three-awns, and lovegrasses occur in the general area, but none of these annuals were found on any of the plots.

Little bluestem is moderately palatable and probably is the most important range grass in the Ozarks. It was increased about one-sixth by release and was the most abundant grass on both released and unreleased plots (Table 3). Apparently little bluestem is more shade-tolerant than broomsedge or panic grass but is a comparatively weak or slow invader.

The perennial panic grasses were more than twice as abundant in the openings as under the trees. They accounted for one-fourth of the grasses on unreleased plots, for one-third of the grasses in the openings, and for 42 percent of the total grass increase. Although less shade tolerant than little bluestem, the panic grasses are quite at home in moderate shade and can increase rapidly if the competition from overstory trees is removed.

Broomsedge, which was present on 9 percent of the released plots but on none of the shaded plots, accounted for much of the visible increase in herbaceous vegetation in the openings. It also accounted for almost one-third of the increase in perennial grasses. Broomsedge rarely occurs under a moderate to heavy forest overstory and apparently is one of the least shade-tolerant grasses in the Ozarks. However, its prolific production of viable airborne seed makes it a conspicuous species in almost all recently made forest openings.

Big bluestem sedges, poverty oatgrass, and "other grasses" were infrequent but were more abundant on the released plots than on the unreleased plots. Indiangrass was the only important grass species recorded that was not more common on the released plots than on the unreleased plots. However, the occurrence of these species was infrequent.

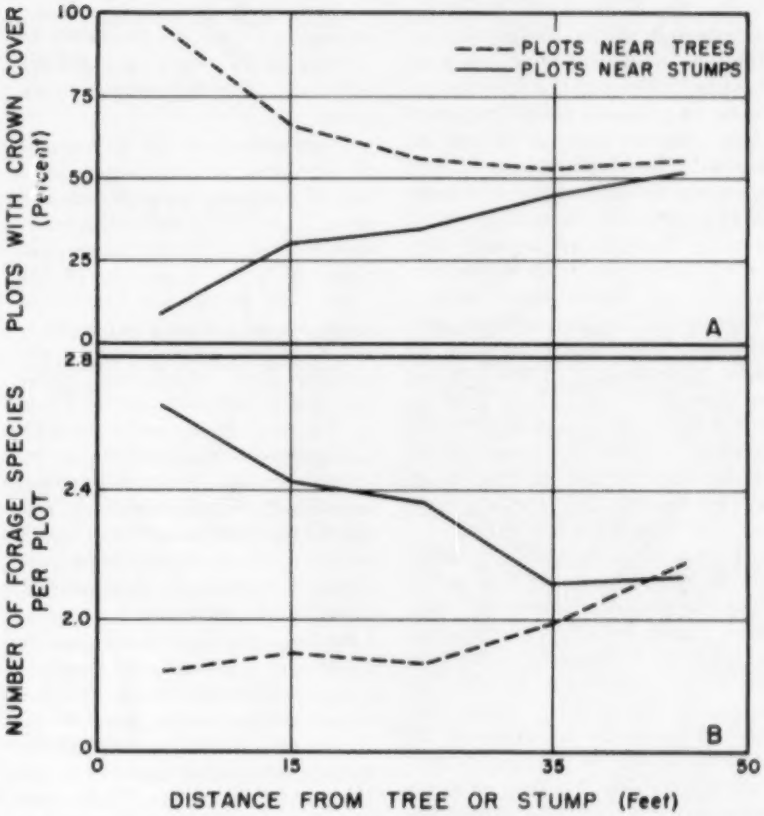

FIG. 2.—(*A*) Percent of plots with crown cover at different distances from trees and from stumps. (*B*) Number of forage species per plot, at different distances from trees and from stumps.

TABLE 3.—FREQUENCY AND SPECIES COMPOSITION OF GRASSES AND GRASSLIKE PLANTS ON SHADED PLOTS AND RELEASED PLOTS

Species	Frequency		Composition	
	Unreleased plots	Released plots	Unreleased plots	Released plots
	Percent			
Broomsedge	0.0	9.0	0	13
Little bluestem	22.9	26.6	64	39
Panic grasses	9.2	22.7	26	33
Poverty oatgrass	.7	1.6	2	3
Big bluestem	.5	.7	1	1
Indiangrass	1.2	.7	3	1
Sedges	.7	3.9	2	6
Other grasses	.7	2.8	2	4
Total	35.9	68.0	100	100

The beneficial effects of cutting overstory trees on forage production for range cattle is measured largely in terms of the effects of release on grasses. Since frequency data take no account of the increased size of plants on released plots, the actual increase in volume of grass produced is probably much greater than the 89 percent indicated by this study. However, relatively poor forage species such as broomsedge, poverty oatgrass, and the panic grasses accounted for almost three-fourths of the increase in grass on released plots. Even so, there was a net gain in good forage grasses and the relatively unpalatable ones are not entirely undesirable because they provide a reserve of forage for dry years.

Increased grass yields in small forest openings should help maintain the grazing capacity of managed Ozark forests. However, the value of such forage for cattle may be limited somewhat because the openings where such forage increases occur are so scattered. It may not always be practical to provide the fencing, herding, or water necessary for cattle to utilize the shifting forage resource in managed timber stands.

Forbs Were the Most Frequent Forage Class

Forbs, the most frequent forage class, made up three-fourths of the herbaceous vegetation under the trees and two-thirds of that in the openings. Many forbs are rated as choice deer forage and some are taken readily by cattle. Almost all forbs that occurred on the plots were perennials.

Fifty-three percent of the forbs on both unreleased and released plots were legumes: Vine lespedezas and tick clovers together made up almost 40 percent of the forb population on both unreleased and released plots. Although the effects were not striking, release apparently was beneficial to the vine lespedezas and detrimental to the tick clovers. Bush lespedezas and wild beans accounted for 10 percent of the forbs on the unreleased plots and for 7 percent on the released plots. Goat's rue, the only other legume present in quantity, is a relatively poor forage plant. Release increased the frequency of legumes by 24 percent but did not materially affect the legume composition.

Composites made up 33 percent of the forbs on unreleased plots and 30 percent of those on released plots. Pussy's toes and asters made up 8 percent each, and woods sunflower made up 7 percent of the forb composition on unreleased plots. These species made up 9, 6, and 6 percent, respectively, on the released plots. Goldenrod, feverfew, and hawkweed together made up 8 percent of the weed composition under the trees and 7 percent in the openings. Although release increased the number of composites only 13 percent, the net forage gain probably was much greater because of the increased size and vigor of plants in the openings.

Forb species lists for the unreleased and released plots were essentially the same (Table 2). The only differences were in relatively infrequent or unimportant species and are attributed mainly to the vagaries of sampling. Plants that occurred on the released plots but not on the unreleased plots were cinquefoil, cudweed, flowering spurge, and false indigo. Plants that were found on unreleased plots only were pencil flower, dogbane, St. Johnswort, and phlox. Seventeen of the 25 forb species listed were present on both released and unreleased plots. Eleven of these were more numerous on released than on unreleased plots and six were more numerous on unreleased plots.

Though not highly palatable, most of the legumes are valuable forage for cattle and deer in the late summer and early fall, especially in hot dry weather. Almost all of the composites are regarded as good deer forage (*2*) and some are used by cattle. Forbs, other than legumes and composites, vary in forage value but are generally more valuable for deer than for cattle.

Summary and Conclusions

Under the conditions sampled, a marked increase in herbaceous vegetation may be expected in the openings created by cutting or girdling the large overstory trees. Many logging or timber-stand-improvement operations in Missouri are not so successful in increasing the yields of forage for deer and cattle. Forage increases may be small because the overstory trees and the resulting openings are small or because there is a dense stand of tree reproduction that either crowds out forage plants or prevents their establishment.

The results reported here are the early effects of release—but the situation is constantly changing. Also, since all data were taken in the late summer or early fall, some species that may have been present earlier in the season may not have been recorded.

Most of the forage plants on both released and unreleased plots were forbs, next came grasses, and last were browse plants. All classes were increased by release.

Forage increases in small forest openings are probably more valuable for deer than for cattle. Not only is the forage more suitable for deer but deer are also better able to utilize the shifting forage resource provided in the small scattered openings of a managed forest.

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Notes

Soil Profile Observations Relating to Drouth Damage in Black Willow Stands

During drouth, black willow (*Salix nigra* Marsh.) is quite sensitive to subsoil differences. Surface inspection alone rarely gives an adequate clue to the quality of the variously stratified alluvial soils on which willow may occur.

In the summer of 1954, drouth damage was noted in a 300-acre willow stand along the Mississippi River. The stand, owned by the U. S. Gypsum Company, was 27 years old, and the trees averaged 100 feet in height. A sharp line of demarcation was observed between healthy and drouth-stricken portions. A single 16-acre area was a complete loss.

Soil pits dug in the 16-acre area revealed that a deposit of 32 inches of heavy clay overlay deep fine sand. Tree roots were found to extend only about 3 inches into the normally saturated but now desiccated sand. Pits in an adjacent healthy stand revealed a much deeper layer of heavy clay, with tree roots penetrating it to 6 feet.

What had been an excellent site under normal weather conditions became incapable of supporting tree growth during protracted drouth. Neighboring sites with different subsurface conditions did not suffer nearly as much mortality.

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[1]In cooperation with the Mississippi Agricultural Experiment Station and the Southern Hardwood Forest Research Group. K. D. Obye, of the U. S. Gypsum Company, assisted in collecting the data.

A Homemade Caliper for Measuring Small Trees

Need for an instrument to measure diameters of small trees to the nearest one-tenth inch prompted design of the homemade caliper shown in Figure 1. This small-tree caliper can be made easily with hand, woodworking tools.

Standard equipment for measuring small trees has several disadvantages. Diameter tapes may kink or break when used to measure small trees. Further, it takes longer to measure a tree with a diameter tape than with a caliper. But regular-sized calipers are large and awkward for measuring trees less than 6 inches in diameter.

The small-tree caliper has been used successfully to measure trees up to 6 inches in d.b.h.; it is particularly adapted for use in young plantations. Although the movable arm can rotate completely around the axis of the beam, experience has shown that correct alignment is a natural reflex and, if proper care is taken, accurate measurements can be made. However, a guide to prevent the rotation of the movable arm can be made with little difficulty.

Make the beam from a $\frac{5}{8}$-inch hardwood (beech, birch, or maple) dowel. Sand or plane a flat surface about $\frac{1}{4}$-inch wide on the beam for the scale. Either India ink or a knife-edge, burning pencil can be used to make the scale marks. If India ink is used, the scale surface will need a light coat of varnish or other protective material. The

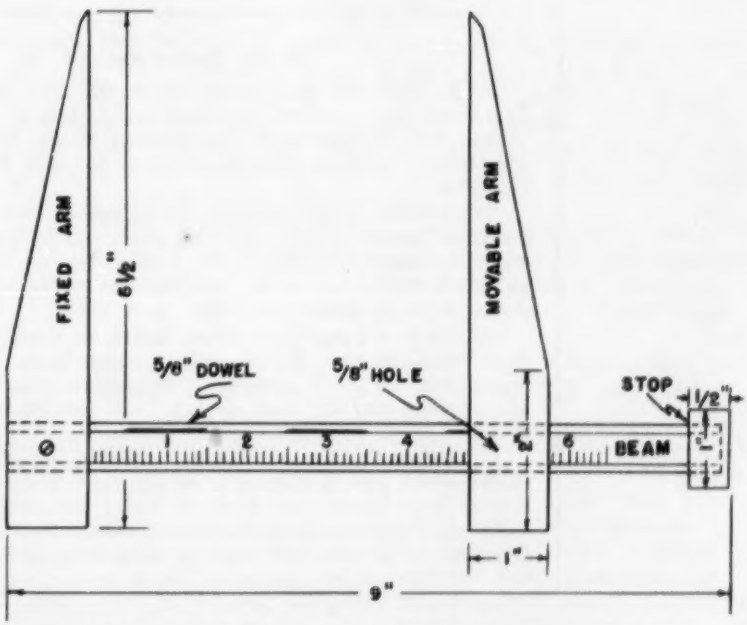

FIG. 1.—Small-tree caliper that can be made easily with hand, woodworking tools.

heavy horizontal marks on the top of the scale coincide with upper and lower limits of 1-inch classes. These marks can be used when trees are being measured to the nearest inch.

Make the arms of the caliper from full 1-inch stock of such wear-resistant wood as oak or hard maple. Glue and screw the fixed arm in place on the end of the beam.

Make a stop (to keep the movable arm from sliding off of the other end of the beam) from a block of wood 1 inch by 1 inch by ½ inch. Drill for the dowel as indicated in the drawing, and attach with glue and a small screw. Other types of stops can be improvised.

Of course calipers with longer arms and beams can be made to measure trees larger than 6 inches in d.b.h.

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High Spruce

A new strain of one of our common conifers, Norway spruce, that will resist the crippling attacks of sleet and snow has recently been introduced into this country and planted in New Jersey. In its native habitat on the upper reaches of the European Alps, this particular variety is known as "high spruce." Over a period of many years, German foresters have succeeded in bringing this race—we call it a variety—down to 900 feet and lower. It adapted itself so well that it is now being extensively planted throughout Germany and Central Europe.

The outstanding characteristic of this race of Norway spruce is the form in which its branches hang. Instead of the ends of the branches pointing up, as do most conifers, they turn down. The trees, especially when snow covered, resemble the artist's, or Christmas card, version of the holiday evergreens.

As a result of this unusual characteristic, ice and snow, instead of piling up on the branches until they break, merely slides off of its own weight when it becomes too heavy. The weighted branch slowly bends down until the force of gravity dislodges the accumulated burden. Even after the trees were planted in the more temperate regions of Germany, they maintained their distinctive form.

The seeds of this spruce in Germany are recognized as coming from trees growing on two types of soil, limestone and other. They are kept separate in the nursery beds and, when the seedlings are planted out in the field, they are assigned to their respective soil types. Even the soils in the nursery beds are treated so that they conform to the soil in which the seed tree grew.

Some hundred thousand seedlings of "high" spruce are now in nursery beds in central New Jersey, with additional quantities of seed available. According to the German foresters, this spruce should do as well in this country as our own Norway spruce. It should be a welcome addition to our planting lists, especially when snow and ice are a hazard and where an attractive and unusual tree form is desired.

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Forester, Interstate Commission on the Delaware River Basin, Bethlehem, Pa.

M. W. Talbot Retired

M. W. Talbot, associate director of the California Forest and Range Experiment Station of the U. S. Forest Service, retired on April 30, after 40 years with the Department of Agriculture. Most of his service as forest and range ecologist and research administrator was in the Southwest and California.

Talbot started his career as a forest assistant on the Coconino National Forest in Arizona, in 1913, following graduation from the University of Missouri. Except for a year in the Army as field artillery lieutenant, he assisted in silvicultural studies, and conducted grazing surveys and range studies in the Southwest until 1923.

In 1924 he was appointed senior botanist with the Bureau of Plant Industry, in Washington. For the next seven years he was in charge of weed investigations of the Department of Agriculture, coordinating principles of controlling farm and range weeds in the United States; a job involving field surveys and cooperation with 30 states.

He returned to the Forest Service in 1931 to organize and direct the range research work in California. In addition to being chief of the Division of Range Management Research, Talbot was acting director of the California Forest and Range Experiment Station from 1941 to 1945, and from 1946 to his recent retirement he was associate director.

Reviews

Composite Volume Tables for Timber and Their Application in the Lake States

By S. R. Gevorkiantz and L. P. Olson. 51 pp. Tech. Bul. 1104. U. S. Dept. of Agriculture. 1955. Supt. Documents, Washington, D. C. 25 cents.

A single volume table that can give acceptable accuracy when applied to any species in a given region has practical advantages over the collections of species tables with which foresters and timber cruisers ordinarily work. Gevorkiantz and Olson present a set of six volume tables that cover every normal cruising situation in the Lake States. The text that accompanies the tables and explains their preparation, testing, and use is a review of volume table fundamentals that every cruiser will find instructive.

The six basic composite tables presented are:

1. Gross volume in board feet (Scribner) by number of 16-foot logs.

2. Gross volume in board feet (International ¼-inch rule) by number of 16-foot logs.

3. Gross peeled volume in cubic feet, entire stem, by total height.

4. Gross volume in rough cords to a variable top diameter inside bark of not less than 4.0 inches, by total height.

5. Gross volume in rough cords to a variable top diameter inside bark of not less than 3.0 inches, by total height.

6. Gross volume in rough cords to a variable top diameter inside bark, by number of 8-foot bolts.

The presentation of the volume tables occupies the first 16 pages. In the final 34 pages there are instructions for making and interpreting tests as to the applicability of the volume tables, a discussion of the factors affecting volume, and methods of adjusting estimates. It is essential to the correct application of the composite tables to individual stands that the last two-thirds of the bulletin be read, understood, and used. The user should realize that, until he becomes familiar with their applicability, the care he must take to check and adjust his estimates is the price he pays for the simplicity and convenience of this compact set of tables.

Tree form, as measured by Girard form class and upper log taper, is the basis for adjusting the board-foot estimates. If trees are form class 79 and have normal taper the table values may need no change. Estimates of timber of different form class but normally associated taper may be revised by the common 3 percent correction for each percent of form class difference. For the uncommon third category of irregular upper log taper, a log-by-log adjustment scheme is suggested, but it would take an expert cruiser to apply.

The cubic-foot volume table is built on the assumption that the average form factor is 42 percent, and that bark volume is 14 percent of total volume. Appropriate adjustments are described for estimates made in stands where form quotient and bark thickness differ from the average. In addition a species factor is listed to correct small systematic differences that remain.

For the cordwood tables, which were derived from the cubic-foot table, adjustments are recommended for care in piling, large differences in form, and for actual degree of utilization. Tables are provided to guide the reader in making the revisions.

This bulletin is another step in the trend toward volume table simplification which in recent years has given foresters useful tables of medium accuracy consistent with the errors to which timber estimates are subject. As long as there exists a sizable error in cull estimation in so many species, there appears to be no reason to reduce volume table errors beyond the practical level of this convenient set.

JOHN CAROW
University of Michigan

Land Judging

By Edd Roberts. 120 pp. Illus. University of Oklahoma Press, Norman, Okla. 1955. $2.50.

The title of this manual explains its contents exactly. The author, an experienced extension soil conservationist from Oklahoma A & M College, presents his reasons for, and methods of, land judging in typically forthright western manner.

He rightfully contends that since the soil is basic to all life we need to develop a greater appreciation for its capabilities and limitations. Land judging can be a tool for learning more about soils, just as livestock judging has enabled many 4-H Club and F.F.A. boys to become experts in livestock production.

Proceeding on this premise, the author presents a brief discussion of the physical characteristics of soils, and of soil tests and classifications, which provide the background for conducting land-judging contests, the basic purpose of the book.

In pursuing his subject, the writer packs this thought into one of his paragraphs, "Last but far from least, soil-judging contests, whether local, state, regional, or national, can be conducted with immense profit to youngsters from the fifth-grade level up through college, and with considerable profit

even to those who have long since passed the school-leaving age. Not competition alone but knowledge is the goal. When people are actually doing things—finding on representative plots of ground the answers that are interesting and vital to them and to their economy—they are making progress."

"But what does land-judging have to do with forestry?" I can hear someone ask. Frankly, I also asked myself that question, as I began reading this little book. Then, as I continued, I reached the conclusion that this manual might have a place in a forester's library for two reasons:

1. It presents basic soil facts that every forester should know.

2. Here is a technique for developing a greater appreciation of our basic soil resources for which the author received a superior achievement award from the Secretary of Agriculture. Foresters, in the educational and public relations fields, might do well to copy a few lines from Edd Roberts' notebook.

MARLIN H. BRUNER

Contributions to Plant Anatomy

By Irving W. Bailey. 259 pp. Illus. Chronica Botanica Co., Waltham, Mass. 1954. $7.50.

This collection of 20 reprinted papers, some of the best work of an unusually productive career, were originally published over the period from 1909 to 1953, and illustrate Dr. Bailey's faith in the value of applying plant anatomy to related fields of science. These connections embrace a variety of interests such as paleobotany, velution, taxonomy, entomology, and forestry.

Part I contains a selection of some of the most significant papers on the cytology of the cambium and its xyleary derivatives. These studies were to be followed by investigations on the structure of the cell wall and the origin, specialization, and evolution of tracheary tissue of land plants.

Part II, biochemistry and biophysics, is basic to many problems in wood technology and decay. The series of six chapters gives much fundamental research useful in the study of specific questions. For instance, the physical structure of cellulose walls has been investigated by careful visual observation as well as by X-ray techniques. Most of this was done in collaboration with Thomas Kerr and Mary R. Vestal, thus adding the skills of other competent technicians in this field. Their findings include physical and chemical causes of layering, structure of fibers, compression wood, early and late tracheids, and various deviations from the usual. Part VII also contains discussion of the pit membrane and other factors affecting the penetration of gas, liquid, and finely divided solid preservatives.

Much of Dr. Bailey's work (Parts III, IV and VI) bears on evidence from anatomy and comparative morphology relative to evolution and classification of plants. His studies on some of the least specialized of living angiosperms serve as a model for the broad but intensive investigation necessary for solving problems of phylogenetic relationships of families of flowering plants as well as the origin of angiosperms.

The final chapter is an abbreviation of a book written with Dr. H. A. Spoehr: *The Role of Research in the Development of Forestry in North America.* Published in 1929, it is interesting to compare its statements and predictions with the history of postdepression forestry. The authors drew attention to needs for fundamental data which underlie nearly every practical problem. They warned against too formal compartmentalization in research organizations; they stated the evils of suddenly pouring huge appropriations into projects with concomitant pressure for quick, spectacular results.

The book is illustrated and ingeniously ornamented by many good drawings and has 23 excellent microphotographs. There are six pages of world literature citations, a subject index, an author index, and a list of plant and animal names mentioned.

PAUL C. LEMON and
KATHERINE H. HEINIG
N. Y. State College for Teachers

Publications of Interest

The Tennessee Valley Authority has published a leaflet, *A Long-Term Forest Management Contract,* which describes a contract developed by TVA's Division of Forestry Relations, TVA's legal staff, and the Southern Timber Management Service, a private consulting firm of Birmingham, Alabama. This contract is now in effect on a number of properties, and several other owners are considering applying it to their lands.

TVA foresters have long believed that adequate private forestry consulting service would fill a great need in the area, and they have encouraged the establishment of consulting firms and helped existing firms improve the quality of their services.

The type of contract described is particularly important in an area where there is a large percentage of absentee ownership.

Copies of the leaflet are available from the Division of Forestry Relations, Tennessee Valley Authority, Norris, Tenn.

• • •

Training Guide No. 4 Use and Care of Power Saws—covers the use and care of the smallest but most frequently used piece of machinery on pulpwood operations—the power saw. This guide includes the key points stressed by A.P.A.'s training and safety officer in training and safety sessions on this equipment. Representatives of power saw manufacturing companies, and of pulp and paper companies using the saws cooperated in editing and reviewing the guide and the *Power Saw Operator's Notebook.*

Training Guides such as this one are prepared by A.P.A. to help pulpwood producers and foremen or other supervisors to train men to do a specific job of producing pulpwood.

Copies are available to non-members from A.P.A., 220 East 42nd St., New York 17, at the following rates: *Training Guide No. 4, 45¢; Power Saw Operator's Notebook, 30¢.*

Current Literature

Compiled by MARTHA MEELIG, *Librarian, State University of New York College of Forestry*

Range Management Section Compiled by FRANCES FLICK, *Library, U. S. Department of Agriculture*

General

The Forester's Companion. By N. D. G. James. Basil Blackwell, London. 1955. 12s. 6d.

Our National Forests. By Bernard Frank. 288 pp. Illus. Univ. of Oklahoma Press, Norman. 1955. $4.00.

The Smoke Jumpers. By Nels Jorgensen. 192 pp. Illus. Bouregy & Curl, Inc. New York 22. 1955. Ages 10-16. $2.50.

TVA and Forestry. 17 pp. TVA Div. of Forestry Relations, Norris. 1955.

Trails West and Men Who Made Them. By Edith Dorian and W. N. Wilson. 92 pp. Whittlesey House, New York 36. 1955. Ages 10 and up. $2.50.

Conservation

Conserving Natural Resources; Principles and Practice in a Democracy. By S. W. Allen. 347 pp. Illus. McGraw-Hill Book Co., New York. 1955. $5.50.

Streams, Lakes and Ponds. By R. E. Coker. 327 pp. Illus. Univ. of North Carolina Press, Chapel Hill. 1955. $6.00.

Farm Forestry

Growing Christmas Trees in New Jersey. By A. H. Lentz. 15 pp. Illus. Rutgers Univ., New Brunswick, N. J. 1955. Ext. Bul. No. 289.

Forest Economics

Area and Ownership of Forest Land in Tehama County, California. By H. L. Baker and Adon Poli. 23 pp. California Forest and Range Expt. Sta., Berkeley. 1955. Forest Surv. Release No. 26.

Lumber Price Relatives: Their Application in the Hardwood Quality Index. By R. I. Beazley and A. M. Herrick. 30 pp. Purdue Univ. Agric. Expt. Sta., Lafayette, Ind. 1954. Sta. Bul. No. 610.

Forest Management

The Volume-Basal Area Line; A Study in Forest Mensuration. By F. C. Hummel. 84 pp. Great Britain Forestry Comm., London. 1955. Bul. No. 24. 9s. (H. M. Sta. Off.)

Range Management

Important Grasses on Montana Ranges. By H. E. Morris and others. 58 pp. Illus. Montana Agric. Expt. Sta., Bozeman. Bul. 500. Oct. 1954.

Some Considerations Concerning the Mapping of Herbaceous Vegetation. By A. W. Küchler. Kansas Academy of Sciences, University of Kansas, Lawrence. Transactions Vol. 57, pp. 449-452. Dec. 1954.

Vegetational Changes in the San Antonio Prairie Associated with Grazing, Retirement from Grazing, and Abandonment from Cultivation. By J. L. Launchbaugh. Ecological Monographs, Duke Univ. Press, Durham, N. C. Vol. 25, pp. 39-57. Jan. 1955. $1.75.

Forest Resources

The Forest Resource of Pine County. 58 pp. Illus. Office of Iron Range Resources & Rehabilitation, St. Paul 1, Minn. 1955.

The Forest Resource of St. Louis County. 71 pp. Illus. Office of Iron Range Resources & Rehabilitation, St. Paul 1, Minn. 1955.

Forest Resources of the Cumberland Lake-Flin Flon Area of Saskatchewan. 32 pp. Illus. Dept. of Natural Resources, Prov. of Saskatchewan. 1955. Forest Inventory Ser. No. 4.

Forest Statistics for California. 66 pp. Calif. Forest and Range Expt. Sta., Berkeley. 1954. Forest Surv. Release No. 25. Mimeog.

Forest Statistics for New York Forest District No. 1 (Revised). 19 pp. Northeastern Forest Expt. Sta., Upper Darby, Pa. 1954. Forest Stat. Ser. New York No. 16. Mimeog.

Forest Statistics for New York Forest District No. 7 (Revised). 17 pp. Northeastern Forest Expt. Sta., Upper Darby, Pa. 1954. Forest Stat. Ser: New York No. 17. Mimeog.

Forests of Louisiana, 1953-54. 64 pp. Illus. Southern Forest Expt. Sta., New Orleans. 1955. Forest Surv. Release No. 75. Mimeog.

Pathology

Red Rot of Ponderosa Pine. By S. R. Andrews. 3 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. 1955. Agric. Mon. No. 23. 30 cents (Govt. Print. Off.)

Silvicultural

Handling Forest Tree Seed. 109 pp. FAO, Rome, Italy. 1955. Forestry Devel. Paper No. 4. $1.00.

Seeding and Planting of Spruce on Cut-Over Lands of the Subalpine Region of Alberta. By A. W. Blyth. 11 pp. Canada Dept. of Northern Affairs and National Resources. Forestry Branch, Ottawa. 1955. Tech. Note No. 2.

Strip-Cutting in a Mixed Pine Stand. By J. W. Fraser and J. L. Farrar. 17 pp. Illus. Canada Dept. of Northern Affairs and National Resources. Forestry Branch, Ottawa. 1955. Tech. Note No. 1.

Tree Planting Practices for Arid Areas. 125 pp. Illus. FAO, Rome, Italy. 1955. Forestry Devel. Paper No. 6. $1.50.

Soils

Mull and Mor Formation in Relation to Forest Soils. By W. R. C. Handley. 115 pp. Illus. Great Britain Forestry Comm., London. 1954. Bul. No. 23. 10s. (H. M. Sta. Off.)

Wood Technology and Utilization

Briquets from Wood Waste. By L. H. Reineke. 7 pp. Forest Products Laboratory, Madison 5, Wis. 1955. Rept. No. 1666-13. Mimeog.

Grinding Pretreated Hardwoods: Experiments on Quaking Aspen, Sweetgum, Red Alder, Black Tupelo, Sugar Maple, Red Oak, and Cottonwood. By Axel Hyttinen and E. R. Schafer. 12 pp. Forest Products Laboratory, Madison 5, Wis. 1955. Rept. No. 2015. Mimeog.

Das Holz. By Hermann Knuchel. 472 pp. Illus. Sauerländer & Co., Frankfurt am Main 1. 1955. DM 27.

Use of Hardwoods in the Manufacture of Newsprint. By G. H. Chidester. 7 pp. Forest Products Laboratory, Madison 5, Wis. 1955. Rept. No. 2027. Mimeog.

Wood Anatomy of the Magnoliaceae Indigenous to the United States. By Eric Stark. 19 pp. Illus. Purdue Univ. Agric. Expt. Sta., Lafayette, Ind. 1954. Sta. Bul. No. 607 .

Officers and Council

1954-1955

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Department of Forestry
University of Missouri
Columbia, Mo.

SCHOOL BOX SCORE[1]
1955 MEMBERSHIP

School	Student applications received: July 1955	Total 1954	Total 1955
Alabama Polytechnic Inst.	0	25	0
University of California	0	11	16
Colorado A & M College	1	18	5
Duke University	1	13	2
University of Florida	1	8	7
University of Georgia	1	35	11
University of Idaho	0	29	3
Iowa State College	0	21	12
Louisiana Polytechnic Inst.	1	0	13
Louisiana State University	0	14	30
University of Maine	0	20	12
University of Massachusetts	0	12	4
Michigan State College	1	43	10
University of Michigan	0	28	12
University of Minnesota	0	23	11
University of Missouri	0	14	3
Montana State University	1	19	20
State University of New York	1	22	21
North Carolina State College	0	39	0
Oregon State College	2	18	12
Pennsylvania State University	1	37	30
Purdue University	2	26	3
Utah State Agricultural Coll.	5	9	12
University of Washington	1	35	22
West Virginia University	0	22	6
Yale University	0	4	16
Total	19	545	293

[1]Adjusted to new record year—now calendar-year basis.

SECTION BOX SCORE[1]
1955 MEMBERSHIP

Section	Applications received[2]: July 1955	Total 1954	Total 1955
Allegheny	1	72	41
Appalachian	1	69	6
Central Rocky Mountain	1	26	6
Central States	4	115	17
Columbia River	6	57	57
Gulf States	4	63	79
Inland Empire	0	40	4
Intermountain	5	15	18
Kentucky-Tennessee	0	5	4
New England	3	54	39
New York	2	39	29
Northern California	1	24	27
Northern Rocky Mountain	2	34	36
Ozark	0	42	15
Puget Sound	3	69	45
Southeastern	4	130	32
Southern California	0	2	3
Southwestern	1	7	11
Upper-Mississippi Valley	0	55	31
Washington	0	8	2
Wisconsin-Michigan	3	13	22
Totals	41	939	524

[1]Adjusted to new record year—now calendar-year basis.

[2]Student, Junior, Affiliate, Associate (initial) grades only.

Society Affairs

The President's Column

Our Society has had representation in the Division of Biology and Agriculture of the National Research Council since 1921. It has been my pleasure and responsibility to represent the Society in this Division during the past four years. When my term expires on June 30, 1955, Dr. H. G. Wilm of our Society will be appointed, as it seems advisable to provide a certain amount of rotation on such assignments.

The National Research Council was established in 1916 by the National Academy of Sciences (a private nonprofit corporation chartered by Act of Congress in 1863 for the furtherance of science and to provide a source of scientific advice to the federal government), and is supported by the cooperation of the major scientific and technical societies of the country. Among its duties are the following:

1. In general, to stimulate research in the mathematical, physical and biological sciences, and in the application of these sciences to engineering, agriculture, medicine and other useful arts, with the object of increasing knowledge, of strengthening the national defense, and of contributing in other ways to the public welfare.

2. To survey the larger possibilities of science, to formulate comprehensive projects of research, and to develop effective means of utilizing the scientific and technical resources of the country for dealing with these projects.

3. To promote cooperation in research, at home and abroad, in order to secure concentration of effort, minimize duplication, and stimulate progress; but in all cooperative undertakings to give encouragement to individual initiative, as fundamentally important to the advancement of science.

The Division of Biology and Agriculture is one of the largest of the eight divisions comprising the National Research Council. Its members are appointed by the president of the National Academy of Sciences and represent 30 national societies serving that many fields of the biological sciences, as well as a few others in and outside of government working in these fields. These members meet in Washington annually to review the activities of the Division, which are carried on through a number of boards, committees, and institutes, each aiming to improve various phases of biological research and their application to the Nation's needs.

At the recent annual meeting on May 13-14 I reported to the Division that the work of our joint committee on a survey of forestry research in North America had been concluded with the publication of a book of about 100,000 words, *Forestry and Related Research in North America,* by Frank H. Kaufert and William H. Cummings. Our committee was then discharged, with the thanks of the Division for having completed its work. The book is now available to Society members for $3 per copy, or $5 to nonmembers. This is a most interesting report of the progress of forestry research during the past quarter-century, the status of current forestry research, and the estimated goals for the next 25 years.

Another matter of interest to our Society is the establishment under the Division of Biology and Agriculture of a new board which will deal with scientific questions concerned with the conservation and wise use of natural resources. Dr. Gilbert White, president of Haverford College, will be the chairman and our Society will be represented in its membership. This board will function as a central clearing house to provide scientific advice on renewable natural resource problems.

One of the objectives of our Society is to promote the science of forestry in America. In this we should continue to cooperate with other technical and scientific organizations. Representation in the Division of Biology and Agriculture of the National Research Council provides an excellent way to keep in touch and work closely with groups representing all the biological sciences. I trust that our Society will maintain this close liaison, which will help build prestige for forestry, give our profession wider recognition by other professional groups, and allow us to better serve the public interest in forestry matters.

E. L. Demmon

Back Copies JOURNAL OF FORESTRY Needed

With the exception of a few issues the Society has an adequate reserve of back copies of the JOURNAL OF FORESTRY. However, through member donations and purchases from members, the Society hopes to rebuild its publications file of currently low-supply issues. Needed at this time are copies of only Volume 50, Nos. 1 and 4 (January and April 1952).

Members may donate these issues or receive credit of 50 cents per copy on their dues. When sending these needed copies please be sure to indicate if they are donated—or if credit on membership dues is desired.

Donations of needed Society publications constitute a cash contribution to the Society because the copies will be sold to members, libraries, and especially foreign forestry agencies that desire to bring their publications file up to date.

English Language Forestry Terminology Coordination Sought

Early this year the Society of American Foresters was requested to participate in an effort to work toward

greater standardization of American and British forestry terms and definitions as a first step toward the compilation of standard, international, multilingual terms. This was an outgrowth of action taken at the 4th World Forestry Conference in setting up a Committee on Bibliography to formulate recommendations on terminologies and multilingual dictionaries. Previously work along these lines had been in process by a joint committee of the FAO and the International Union of Forest Research Organizations. Plans as developed called for the use of English as the agreed basic language and the coordination of terms and definitions in this language with any other language through a system of Universal Reference Numbers, maintained by card index. An effort to iron out needless differences between British and American terms was called for, particularly in those instances where British terminology uses American definitions in a modified sense. Where necessary differences existed they needed to be clearly defined to avoid confusion on translation into other languages.

As an outgrowth of this undertaking the Commonwealth Forestry Bureau invited the Society to send a representative to Oxford, England, for the purpose of working with representatives of the Committee on Bibliography. Expenses for the trip were made available to the Society. At the direction of President Demmon, Journal editor Arthur Meyer spent three weeks at Oxford during June. Necessary differences between British and American terminology were deliniated and recommendations developed for means to reconcile mutually used definitions.

Further reports on the progress of this international undertaking in forestry terminology will be made as available.

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Fifth Call for Council Nominations

All voting members are hereby notified that the regular biennial election will be held December 3, 1955. A president, vice president, and nine other members of the Council will be elected for the two-year term 1956-1957.

The present Council is listed in the box on page 522. Any or all of these incumbents may be renominated, provided they accept the nomination in writing.

President Demmon has announced that he will not be a candidate for re-election.

Membership on the Council is restricted by the Constitution to Members (formerly Senior Members) and Fellows. Any Member or Fellow is eligible to hold office who is in good standing and who accepts the nomination in writing and declares his willingness to serve if elected.

Each voter will have an opportunity to ballot on all candidates for office. Council members are elected in accordance with the system of proportional representation. The procedure of proportional representation will be explained in a later issue of the JOURNAL. It is the system by which the Society has been electing Council members for two decades.

Candidates for the office of president are voted on separately; the candidate who receives the highest vote is declared elected president, and the candidate who receives the next highest vote is declared elected vice president.

How Nominations Are Made

The Constitution (Article VIII, Section 2) states the conditions under

(Continued on page 526)

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ANOTHER BIG STEP AHEAD IN LOW-COST DIRT MOVING

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New Wrap-Around Radiator Guard used as dozer lift frame to simplify design, reduce cost of bulldozer; guard tilts forward for easy service.

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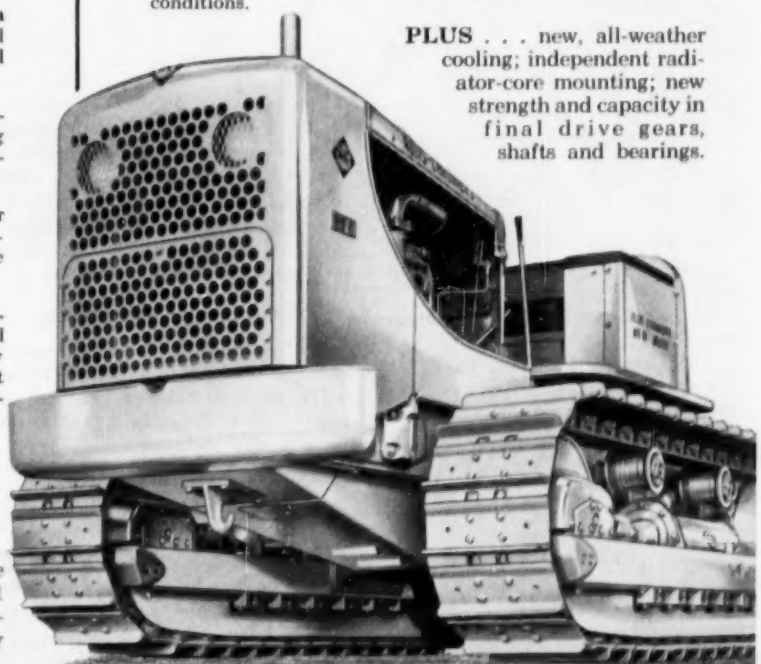
PLUS . . . new, all-weather cooling; independent radiator-core mounting; new strength and capacity in final drive gears, shafts and bearings.



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which nominations are made by petition.

1. Each petition shall name but one candidate.

2. All candidates must be eligible to hold elective office.

3. A petition shall bear the signatures of at least ten voting members who at the time of signing the petition are eligible to vote in the coming election. (Eligible voting members are Junior Members, Members, and Fellows in good standing.)

4. A voting member may not sign more than one nominating petition for President or more than one nominating petition for a member of the Council. That is, he may sign two, but no more.

5. Petitions must be in the Society office by October 1, 1955.

The Society has no special form for submitting nominating petitions. They may be written as follows:

We, the undersigned voting members of the Society of American Foresters, hereby nominate John Doe, a Member (or Fellow), for the office of President (or member of the Council) for the two-year term 1956-1957.

All nominating petitions should be sent promptly to the Society office. The executive secretary will gladly provide information about nominating or election procedure.

Nominations Received

On the date this issue went to press the following nominations had been received.

For President: DeWitt Nelson, Sacramento, Calif. (Vice president, 1954-1955.)

For the Council: B. E. Allen, Savannah, Ga.

N. T. Barron, Franklin, Va.

P. A. Briegleb, New Orleans, La.

C. H. Coulter, Tallahassee, Fla. (Council member, 1954-1955.)

S. G. Fontanna, Ann Arbor, Mich. (Council member, 1954-1955.)

E. F. Heacox, Tacoma, Wash. (Council member, 1954-1955.)

William P. House, Chesham, N. H.

J. S. Illick, Syracuse, N. Y. (Council member, 1954-1955.)

J. H. Stone, Portland, Ore. (Council member, 1954-1955.)

Henry J. Vaux, Berkeley, Calif.

The Nominating Committee will make no nominations of its own unless the voting membership fails to make the required minimum number of nominations by petition. Voting members should accordingly get busy and make their own nominations.

A. R. BOND, *Chairman,*
Nominating Committee

Nominations for Grade of Fellow Now Open

All Members (formerly Senior Members) and Fellows of the Society are hereby advised that nominations for the grade of Fellow are now open. The election of Fellows will be held at the time of the Society's regular biennial election, December 3, 1955.

As defined by the Constitution (Article III, Section 6), "Fellows shall be foresters of outstanding achievement as leaders in responsible directive or distinctive individual work of a fruitful character. They shall be elected from the Members and shall be engaged in forestry work at the time of their election."

Nominations by Petition

The procedure for placing Members in nomination for the grade of Fellow is by petition. The Society has no printed form for this purpose; the petition may be typewritten thus:

We, the undersigned Members and Fellows of the Society of American Foresters, hereby nominate ———— for election to the grade of Fellow in 1955.

Remember these simple rules:

1. A petition may not name more than one candidate.

2. It must be signed by 25 Members or Fellows in good standing.

3. It should be accompanied by a factual, not eulogistic, biographical sketch of at least 200 words giving an account of the nominee's professional career and accomplishments.

4. It must be received in the executive office of the Society in Washington, D. C., not later than October 1, 1955.

The executive employees of the Society cannot be responsible for obtaining signatures on partially completed petitions or on petitions incomplete by reason of unacceptable signatures (that is, signatures of other than Members and Fellows in good standing).

Nominations Received

On the date of going to press, the following Members had been nominated for the grade of Fellow:

S. B. Detwiler, Colo.
J. F. Dubuar, N. Y.
S. G. Fontanna, Mich.
J. A. Hall, Wis.
F. H. Kaufert, Minn.
F. P. Keen, Calif.
C. W. Richen, Ore.
P. C. Wakeley, La.

Election Procedure

Fellows are not elected by the membership at large, but by a board of electors which consists of all present Fellows and the present Council. (A Council member who is also a Fellow has but one vote.)

To win election a candidate must receive an affirmative vote of not less than one-half the total votes cast.

(Continued on page 528)

TREE CLIMBERS

Save time, eliminate leg irons, by using

LIGHTWEIGHT MAGNESIUM LADDERS.

Built in Sections, 6', 7', 8', especially for tree climbing purposes. Sections fit into each other and brackets hold ladder away from tree to provide toe hold for climber.
Weight: 1¼ lbs. per foot. Reasonably priced. Long lasting. Guaranteed.

A Complete Line of Ladders—All Types

MODERN MAGNESIUM PRODUCTS, INC.
Palmer, Massachusetts

MAKING WOOD SERVE AMERICA BETTER THROUGH GOOD FOREST MANAGEMENT

WILLIAM B. GREELEY, one of America's forestry leaders. He helped inspire *voluntary* conservation by farmers, timber owners and the public . . . including Keep America Green and More Trees for America movements. U. S. Chief Forester, 1920-28; manager West Coast Lumbermen's Assn., 1928-45; now Board Chairman, American Forest Products Industries.

pioneering the idea of voluntary forest conservation...

Wood is used in more than 4,000 products . . . from homes to paper, rayon, cellophane and tissues. There can always be wood for such uses from privately owned tree farms.

"True forest conservation can be accomplished more by the voluntary cooperation of individuals, rather than by law." Guided by this practical philosophy, Col. W. B. Greeley and many other thoughtful men of forestry have inspired exceptional progress in perpetuation of the nation's wood supply. It is the American way. It reflects more confidence in education and persuasion than in arbitrary authority. This faith has been rewarded by growth of the tree farm movement throughout the nation.

Today, about 6,100 industrial and farm woodland owners are *voluntarily* growing timber as a crop on 34 million acres certified as tree farms. And *voluntary* cooperation by the public, industrial foresters and government forest agencies is reducing forest fire losses, year by year.

Timber harvest and new timber growth are now practically in balance. Commercial forestlands are providing a permanent supply of wood for lumber, paper and chemical products. Weyerhaeuser Timber Company is among those who voluntarily manage forestlands for perpetual wood production. The full story of modern tree farming is interesting. *For more complete information, write us at Box A, Tacoma, Washington.*

Weyerhaeuser Timber Company

All Over The
UNITED STATES

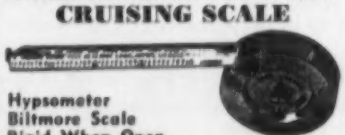
TRAINED FORESTERS
are using
all types of our
forestry tools and
equipment

Write for your
copy of the
FREE
CATALOG

We Can Supply Your Needs

Forestry Suppliers
INCORPORATED
132 RAYMOND ROAD
JACKSON, MISSISSIPPI

COMPLETE INVENTORY
CRUISING SCALE



Hypsometer
Biltmore Scale
Rigid When Open
Flexible 6-foot Steel Tape $3.00 EACH
Handy Chrome-plated Case 1¾" Dia.
IMMEDIATE DELIVERY
CARL W. GETZ, President
KURFEW, INC.
Lansdale, Pa.

GROW TREES
FOR XMAS TREES AND FORESTRY
Fir, Pine and Spruce in Variety
Seedlings and Transplants
Write for Price List
Suncrest Evergreen Nurseries
P. O. Box 643, Johnstown, Pa.

Significance of the Grade

The highest membership distinction that can be conferred by the Society, this grade is awarded in recognition of outstanding achievement. Fellows do not pay increased dues; their dues are the same as those of Members.

Since the Society was founded in 1900, there have been 100 Fellows elected. At the present time the number of living Fellows is 69.

The current roster of Fellows appears on pages 466-467 of the June issue of the JOURNAL.

Schedule of Events and Announcements
Society of American Foresters Annual Meeting

The fifty-fifth annual meeting of the Society of American Foresters will be held in Portland, Oregon, October 16-19. Headquarters will be the Multnomah Hotel.

The theme of the meeting is "Converting the Old Growth Forest."

The following information should enable members to make advance plans and to request room reservations. The preliminary program of speakers and topics for all sessions will appear in the August issue.

Schedule of Events

As shown by the following schedule of events, numerous meetings and technical sessions have been arranged to provide attractions for a diversity of interests.

Saturday, October 15

Council of Forestry School Executives: morning and afternoon.

Sunday, October 16

S.A.F. Council meeting: morning and afternoon.

Committee on Accrediting: afternoon.

Editorial Board, JOURNAL OF FORESTRY: evening.

Joint meeting of Council with Section and Chapter officers: evening.

Association of Consulting Foresters: evening.

Monday, October 17

Opening General Session: morning.

Society Affairs Session: afternoon.

Dinner Period: Forestry School Alumni Get-togethers.

Division of Private Forestry: evening.

Division of Education: evening.

Division of Public Relations: evening.

Tuesday, October 18

Division of Silviculture: morning and afternoon.

Division of Range Management: morning.

Division of Forest Recreation: morning.

Division of Forest Products: afternoon.

Division of Forest-Wildlife Management: afternoon.

Social evening with Columbia River Section and Puget Sound Section as hosts.

Wednesday, October 19

Division of Forest Management: morning and afternoon.

Division of Economics and Policy: morning.

Division of Watershed Management: afternoon.

The annual Society Dinner: evening.

October 20 and 21

Field Trips.

Field Trips

Thursday, October 20

Industrial Tree Farm Tour.—Tree Farms in the Columbia River area between Portland and Astoria will be visited, and particularly the Columbia and Clatsop Tree Farms of the Crown Zellerbach Corporation. There will be an opportunity to see thinning operations of young Douglas-fir stands and logging methods. Logging of old-growth hemlock-spruce forests along the Pacific Ocean will show the modern, highly flexible logging equipment now commonly used in the Pacific Northwest. Plantations, fire protection measures, woods utilization, and growth of young stands will be seen.

Tillamook Burn Tour.—This tour will show the steps being taken by the Oregon State Forestry Department to rehabilitate state-owned lands in the Tillamook Burn—an area of about 300,000 acres in Northwest Oregon which was burned three successive times by the disastrous forest fires of 1933, 1939, and 1945. The group will see what now is probably the world's largest forest rehabilitation project in which the Burn is being fireproofed by salvage logging, snag falling, and road building, and reforestation by planting and aerial seeding.

Friday, October 21

Mt. Hood National Forest Tour.—The Mt. Hood National Forest is close to the metropolitan Portland area. It is a forest of 1,108,998 acres. The tour will visit the Clackamas Working Circle of the forest where modern forest practices and logging methods used in the Pacific Northwest can be seen. Timber sale procedures, access road development, and forest management policies of the U. S. Forest Service which are typical of problems on federal lands in the West will be viewed.

Forest Industries Tour.—This tour will visit the forest industries of Longview, Wash., which represent the most integrated forest utilization center of the world. Here will be seen veneer and plywood manufacture, sawmilling, pulp and paper production, bark utilization, shingle and shakes manufacture, pole and piling yards. Plants of the Weyerhaeuser Timber Company, Long-Bell Lumber Company, and Longview Fibre Company will be visited.

The four field trips described above are all-day tours. Ladies are cordially invited to attend any except the Tillamook Burn Tour. Additional information regarding these trips will appear in the August issue.

Hotel Reservations

It is suggested that those expecting to attend the meeting arrive in Portland on Sunday, October 16, or not later than the morning of Monday, October 17. The open meetings start on Monday morning.

The Multnomah Hotel will be the headquarters hotel where most scheduled events will be held. Although the Multnomah contains 600 rooms, it will not be able to accommodate all those in attendance, hence other hotels are cooperating.

(Continued on page 531)

SOCIETY OF AMERICAN FORESTERS
ANNUAL MEETING
Portland, Oregon. October 16-19, 1955

....., 1955

Housing Committee, Society of American Foresters,
c/o Portland Chamber of Commerce,
824 S. W. Fifth Avenue,
Portland 4, Oregon.

First Choice Hotel .....
Second Choice Hotel .....
Third Choice Hotel .....

Please make a reservation for the following room accommodations for arrival on October ....., a.m. / p.m. Departure date, October .....

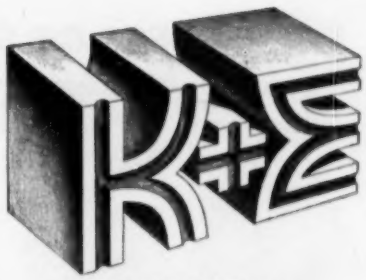
I understand that accommodations will be provided at the daily rate specified, if available; otherwise the next nearest rate will apply.

..... Single room with bath. Rate, $.....
..... Double-bed room with bath. Rate, $.....
..... Twin-bed room with bath. Rate, $.....
..... Suite (parlor, twin-bed room, and bath). Rate, $.....
..... Other. (Specify accommodations desired.) .....
..... Rate, $.....

The above room accommodations are requested for the following persons, in addition to myself. (Print or typewrite names and addresses legibly.)

.....
.....
.....

My name: .....
Street address: .....
City, zone, state: .....

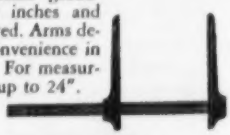


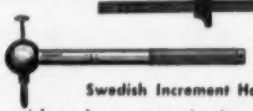
FORESTRY INSTRUMENTS

Conforming fully to the high quality standards established by K&E products, these forestry instruments are light in weight, compact, portable, handy – and extremely rugged. For further information about them ask any K&E Distributor or Branch, or write Keuffel & Esser Co., Hoboken, New Jersey.

Swedish Increment Borers
Best instrument yet devised to determine the characteristics of standing timber. Made of the finest Swedish steel. Demountable for easy carrying, bits come in a variety of sizes for bores of many different lengths and diameters.

Tree Caliper
Hardwood, with the eye of the sliding arm brass lined all around. Beam graduated to 10ths inches and plainly numbered. Arms detachable for convenience in transportation. For measuring diameters up to 24".





Swedish Increment Hammer
For quick and easy examination of the bark and the last few year rings of a tree. When swung as a hammer, the hole pipe enters the bark at a right angle. When hammer is removed from the tree, a bark and wood sample is ejected by a plunger.

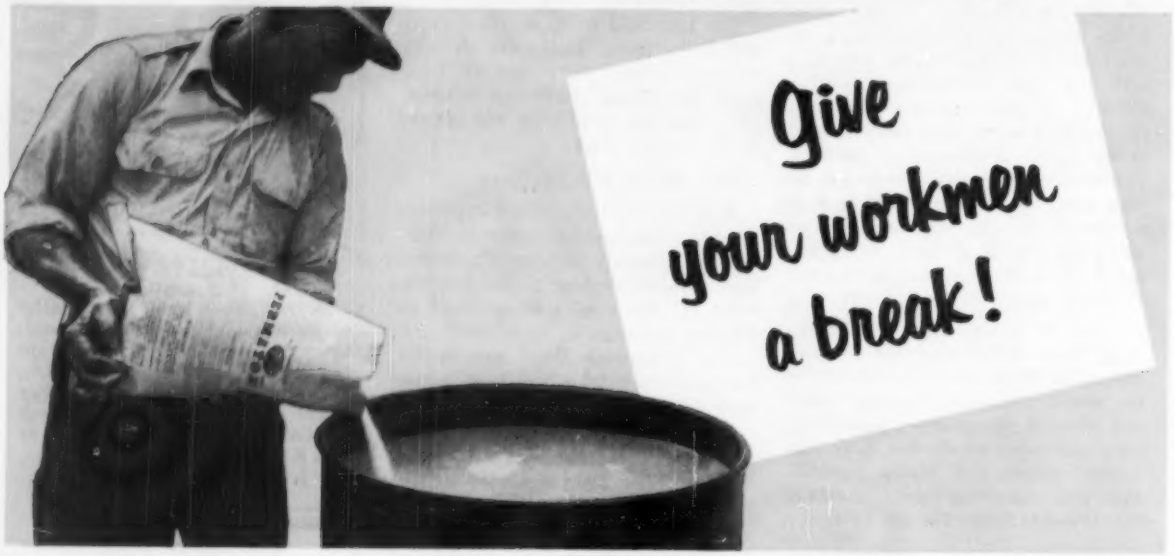
Swedish Bark-Measuring Instrument

Plunger is graduated in inches and tenths of an inch.

Timber Scribe
Wooden handle, 7 in.

KEUFFEL & ESSER CO.
Est. 1867
Drafting, Surveying, Reproduction, Optical Tooling Equipment and Materials · Slide Rules · Measuring Tapes
New York • Hoboken, N. J.
Detroit · Chicago · St. Louis · Dallas
San Francisco · Los Angeles · Seattle · Montreal

USERS OF SAP STAIN CONTROL CHEMICALS:



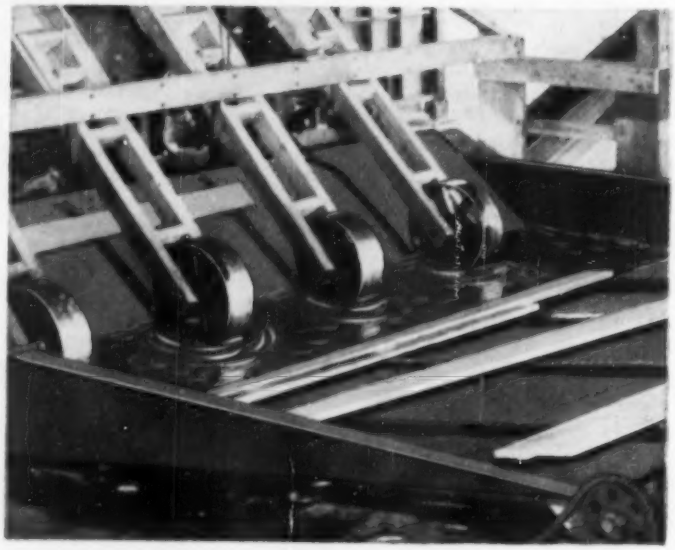
No irritating dust problem with Permatox 10-S

New ingredient makes Permatox 10-S easier to handle and mix than ever before

Since 1933 Chapman has conducted continuous research to improve sap stain chemicals and methods of application. The newest Chapman research development in this field makes Permatox 10-S practically dust-free by the addition of a new ingredient to this tried-and-proven formula.

There is no increase in price for this improved Permatox 10-S.

Permatox 10-S prevents *both* sap stain and mold in hardwoods and softwoods. Mixed with Chapman Ambrocide, it also protects lumber against damaging attacks by ambrosia beetles and other insects.



CHAPMAN CHEMICAL COMPANY
Memphis 3, Tenn.
1238 N.W. Glisan, Portland, Ore.

Write For Free Bulletin on Stain and Insect Control

CHAPMAN®

PERMATOX 10-S

Prevents <u>both</u> sap stain and mold, in freshly cut hardwoods <u>and</u> softwoods

A special S.A.F. Housing Committee has been set up for the meeting, and all requests for room reservations should be addressed to this committee, as follows:

Housing Committee, Society of American Foresters; c/o Portland Chamber of Commerce; 824 S. W. Fifth Avenue; Portland 4, Oregon.

The reservation coupon printed herewith may be used. Subscribers who do not wish to cut the coupon from their JOURNALS may request reservations simply by providing the Housing Committee with all the information requested on the coupon.

Each reservation request should indicate first choice, second choice, and third choice hotels. As usual, single rooms may be scarce, hence when possible twin-bed rooms should be used.

There follows a list of cooperating hotels and their rates. All quoted rates are with bath unless otherwise noted. Some hotels have rooms with connecting baths at lower rates.

Hotels

Multnomah Hotel, S.W. Fourth Avenue and Pine Street. Single rooms, $6 to $8; double, $8 to $13; twin beds, $9 to $13. Sets of twin-bed rooms and double rooms connecting, for four people, $15 to $16. Suites available.

Benson Hotel, S. W. Broadway at Oak Street. (Four blocks from the Multnomah.) Single, $6 to $10; double, $8 to $15; twin beds, $11.50 to $15.

Imperial Hotel, S. W. Broadway at Stark Street. (Five blocks from the Multnomah.) Single, $4 to $6; double, $6 to $8; twin beds, $7 to $9.

Congress Hotel, S. W. Sixth Avenue and Main Street. (Ten blocks from the Multnomah.) Single, $5.50 to $7; double, $6 to $8; twin beds, $7.50 to $8.50.

New Heathman Hotel, 712 S. W. Salmon Street. (Eleven blocks from the Multnomah.) Single, $6.50; double, $8; twin beds, $8.50.

In addition to the foregoing hotels, there are other smaller hotels within the downtown area. The Housing Committee will supply a list of these hotels with their addresses for those who request it.

Motels and motor courts are available outside the downtown area. Their rates for single rooms with bath are from $5.50 up; doubles are $6.50 and up. The Housing Committee will make motel reservations, or will furnish members with a list of motels for those who may wish to request their own reservations.

Meeting Committees

The general chairman for the meeting is J. Herbert Stone, U. S. Forest Service, 729 N. E. Oregon Street, Portland 8, Ore.

Assisting him are the following committees and their personnel.

Program Committee

The chairman of the Program Committee is W. F. McCulloch, School of Forestry, Oregon State College, Corvallis, Ore. The other members are K. G. Fensom, Roger Guernsey, Clare Hendee, and A. J. Sandoz.

Arrangements Committee

The chairman of the Committee on Arrangements is Clarence Richen, Crown Zellerbach Corp., 1400 Public Service Building, Portland, Ore.

Assisting him is Laurence C. Jolley, U. S. Forest Service, 729 N. E. Oregon Street, Portland 8, Ore.

Heading up special task committees are the following individuals:

Information and Publicity, Albert Arnst.

Hotel Reservations and Housing, Howard Roberts.

Registration and Welcome, Martin L. Syverson.

Exhibits, Arthur K. Roberts.

Field Trips, Nels Jeffers.

Ladies Entertainment, Mrs. Robert Conklin.

Meeting and Conference Rooms, Owen Cramer.

Annual Dinner Arrangements, Paul Vance.

Projection and Amplifying Equipment, Clyde Stratton.

"Sergeant-at-Arms," Louis Alexander.

Special Assignments, Robert D. Hostetter.

For the Control of HARDWOODS & MIXED BRUSH in *Conifer Stands*

Thompson Chemicals

The latest technological development in the use of modern, broad spectrum herbicides is contained in our current STATION PAPER 19. You are invited to write for your free copy.

Thompson's STATION PAPER 19 reports on four years of laboratory and field research of unduplicated magnitude. It covers accurate, important data on both foliage and basal spray techniques, comparative kills by various esters and provides criteria for evaluating costs.

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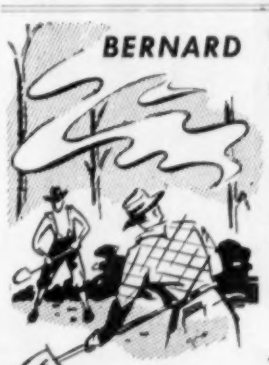
Research Department
THOMPSON CHEMICALS CORP.
3032 Locust Street, St. Louis 3, Mo.

We will also be pleased to provide information on specific problems.

20 MILLION TREES A YEAR!
FREE Catalog
Evergreen Seedlings—Transplants. Fruit and Shade Trees, Shrubs and Rhododendrons
Free Christmas Tree Growers' Guide
MUSSER FORESTS Box 26-C Indiana, Pa.

SILVA COMPASS
Simpler — More Accurate
Recommended by foresters for cruising. Easier to use, faster, positive. Direct course readings. *Write for free literature and instructions.*
SILVA, INC., Dept. J, La Porte, Ind.



Kamp-Pack
"OUTDOOR FOOD" HELPS RANGERS, FORESTERS, TRAVEL LIGHT and FAST
Delicious non-perishable food is concentrated for easy carrying. 25 pounds finished food weighs only 9 pounds. Nothing to add but water. 12 full meals in waterproof foil packets. Used by forest rangers as regular food for lookouts, emergency food when fire-fighting. Used by foresters, too.
Write for KAMP-PACK booklet and Bernard INSTITUTIONAL FOOD LISTS for *he-man* lumberjack meals.
BERNARD FOOD INDUSTRIES . . . 2 plants to serve you
P O. Box 487, San Jose, Calif. • 559 West Fulton Street, Chicago 6, Ill.

J. HERBERT STONE, general chairman of the Society's 55th annual meeting, Portland, Oregon, October 16-19.

Current River Natural Area

The Society of American Foresters Committee on Natural Areas published in the April 1952 (Volume 50, No. 4) issue of the JOURNAL OF FORESTRY a plea for assistance in the location of virgin type associations which might qualify as Natural Areas. In response to this request, the Committee was apprised of a stand of virgin white oak near Emminence, Missouri owned by the National Distillers Products Corporation of New York City.

The Committee discussed with the Corporation the objectives of the Society in its program of providing for the reservation of adequate samples of every forest type in order to fulfill the need of all practicing foresters for a comprehensive knowledge of natural developments within virgin forest associations. When the Corporation viewed with favor the proposal that a small acreage of its white oak forest be set aside as a Natural Area, a Committee of the Ozark Section selected a ten-acre tract in the County of Shannon, Missouri and marked the boundaries thereof.

At about the time this field work had been completed the Corporation sold its timberlands to Leo A. Drey of Clayton, Mo. reserving certain timber cutting rights for a limited period. At this point, R. H. Westveld, chairman of the Department of Forestry, University of Missouri, George O. White, state forester, and R. E. McDermott, chairman of the Ozark Section, rendered immeasurable assistance in establishing negotiations with the new owner. Mr. Drey has been most cooperative and has extended his personal facilities to the consummation of an arrangement whereby this area is now legally recognized and set aside as the Current River Natural Area.

There is attached a copy of an indenture and an agreement entered into on March 1, 1955 and recorded in the County of Shannon, Missouri on April 13, 1955. The indenture is entered into between Mr. Drey, the owner of the property, and Messrs. Drey and John F. Shanklin as trustees for the administration of the Natural Area.

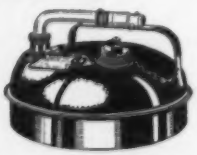
The agreement, entered into between the National Distillers Products Corporation, Mr. Drey and Mr. Shanklin, reserves the timber from being cut on the Natural Area during the life of the

USE EAGLE TREE MARKING GUNS for QUICK, CLEAN, EASY MARKING

These modern Eagle Tree Marking Guns operate easily. A slight thumb pressure on the pump trigger discharges the paint directly to the tree to be marked—good spots as far as 12 feet. Paint sprays freely—amount of paint readily controlled. Non-clogging ball valves—machine cut threads—detachable nozzle—ground brass pump plunger. Easily taken apart for quick cleaning. ½, 1 and 2 pt. cap.

And, for special numbering jobs, use the Eagle Super#66. A precision pump marking gun—takes undiluted but strained outside paint. Successfully service tested on 40,000 Lake Region trees. 6 oz. cap.

THE EAGLE FLAT-JAK NEW SAFETY FILLER CAN



Designed for POWER SAWS and TOOLS

The new Eagle Flat-Jak is Underwriters' Approved for outdoor use. It is a low, squat filler can ideal for forest service. Automatic shut-off valve eliminates spilling and splashing . . . safety valve releases excessive pressure. Gasoline flows by gravity through brass swing-around pouring spout when valve cross-bar is pressed against tank mouth. Two sizes: 1¼ and 2½ gallon capacity.

Order from your supply dealer or write for further information.

Eagle products are also available in Canada.

EAGLE MANUFACTURING COMPANY THE COMPLETE LINE Wellsburg, West Va.

cutting reservation held by the Corporation, provided the area is maintained as a Natural Area. The Corporation's reservation expires June 1, 1960 but it is likely to be relinquished in advance of that date.

The trustees for the area have selected Dr. Westveld to be primarily responsible for the coordination of research activities on the Current River Natural Area. It is expected that the Ozark Section and the state forester of Missouri will assist Dr. Westveld to the end that this Natural Area may be utilized for worthy research projects.

In conclusion, it should be emphasized that this Natural Area has come into being only through the generosity and cooperation of the National Distillers Products Corporation and Mr. Drey. An official letter of thanks has been issued by the Society to the Corporation and Mr. Drey.

JOHN F. SHANKLIN, *Chairman*
Committee on Natural Areas

The Indenture

THIS INDENTURE, made on the 1st day of March, 1955, by and between LEO A. DREY, of the County of St. Louis, State of Missouri, Party of the First Part, and said LEO A. DREY and JOHN F. SHANKLIN, of the District of Columbia, Parties of the Second Part, for themselves and their successors, as hereinafter provided, hereinafter sometimes called "Trustees,"

WITNESSETH, That: The said Party of the First Part, in consideration of the sum of One Dollar ($1.00) to him paid by the said Parties of the Second Part, the receipt of which is hereby acknowledged, does by these presents remise, release, and quit-claim unto the said Parties of the Second Part the following described lots, tracts, or parcels of land lying, being, and situate in the County of Shannon, in the State of Missouri, to-wit:

> The SE¼ of the NE¼ of the NE¼ of the NE¼ and the NE¼ of the SE¼ of the NE¼ of the NE¼ of Section 33, Range 3 West, Township 30 North, containing 5 acres, more or less, and the SW¼ of the NW¼ of the NW¼ of the NW¼ and the NW¼ of the SW¼ of the NW¼ of the NW¼ of Section 34 in Range 3 West, Township 30 North, also containing 5 acres, more or less,

together with the right of ingress and egress to and from said premises over lands now owned by said Leo A. Drey, Party of the First Part, (on foot or by such vehicle as may be usable in the terrain as it now is, without improvement, and granting no right to Parties of the Second Part to build or grade any road or to improve any passage, whether by cutting timber or otherwise) for grantees, their agents and licensees, along the most direct, feasible route from the Public Highway known as Missouri Highway 19.

PRUNING FOR PROFIT

Bartlett Mfg. Co. offer the M-414 MEYLAN PRUNING SAW which consists of the use of an axe handle with the Bartlett No. 44 Pole Saw Head except that a special blade of heavier tool steel is used and can be furnished in either 16-in. or 18-in. length. The axe handle, which is especially made for this saw is properly tapered to fit the head and is 36-in. long.

Because the Meylan Saw will enable a man of average height to prune 9½ ft. from the ground, it has made a saving in pruning coniferous plantations as great as 25%.

The Saws are available for prompt shipment, delivered to any address in U.S.A. at the following prices.

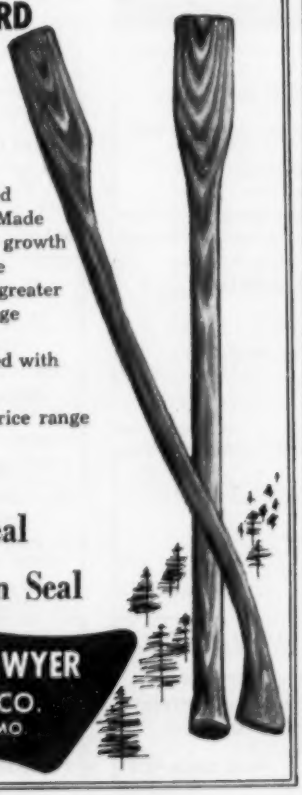
M-414 Meylan Saw, complete with 16-inch blade $12.00

M-414 Meylan Saw, complete with 18-inch blade $12.50

Bartlett Mfg. Co.
3015 E. Grand Blvd.
DETROIT 2, MICHIGAN

Ask for Catalog No. 35

SLIM or STANDARD PATTERN
Axe Handles



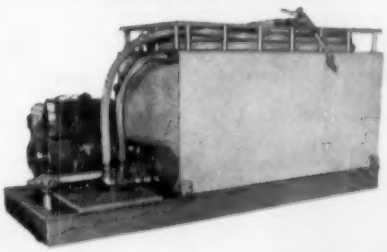
Designed and balanced for rough, hard use. Made from selected, second growth heavy hickory. Triple inspected. You have greater strength—less breakage with Seal Brands.
Wood wedges included with each handle.

Choose from your price range

- Gold Seal
- Blue Seal
- Green Seal

LaPIERRE-SAWYER HANDLE CO.
JACKSON, MO.

PANAMA



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TO HAVE AND TO HOLD the same, with all the rights, immunities, privileges and appurtenances thereto belonging, unto the said Parties of the Second Part and their successors and assigns, IN TRUST, however, for the uses and purposes, and with the powers, duties and immunities hereinafter set out, so long as said premises shall be used and devoted to the purposes hereinafter stated, and when said premises shall cease to be so used and devoted, then said premises shall revert to Pary of the First Part as of his former estate, and he may reenter into the same and take possession thereof.

(A) Said premises shall be held and used as a natural area and the timber and other vegetation shall be allowed to grow thereon, except to the extent that the Trustees shall deem it advantageous and in the interest of the study of forestry to cut or to remove the same. The proceeds of the sale of any timber or other valuable crop from said premises shall be paid to the Trustees, to be expended for the maintenance and improvement of said premises as a natural area, and any amounts which the Trustees shall deem surplus and beyond the requirements for said purposes shall be paid to the University of Missouri for the advancement of the study of forestry. Except as aforesaid, the Trustees shall not have authority to sell, pledge, encumber, or otherwise dispose of the said premises or any of the produce thereof, nor to lease the same.

(B) The Trustees shall have no personal liability or responsibility to protect said premises from fire, theft, or injury or damage from any source whatsoever, nor shall they be personally liable for the payment of taxes or any other charges upon said premises, but shall pay such taxes and other charges only as and to the extent monies may be available to them to do so.

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(C) The Trustees shall permit foresters, scientists, and students of natural history to enter upon the said premises for the purpose of studying the growth, ecology, and other characteristics of the trees and other plants upon said premises, and also for the purpose of studying geology, rock formations, and any other natural characteristics of said area, and may allow them to remove samples for scientific collections and studies of wood, seeds, ores, rocks and other plant and mineral formations; provided that nothing herein written shall be construed to enlarge the easement of ingress and egress hereinbefore granted. The Trustees may employ agents and may delegate their authorities and discretions hereunder from time to time, and from time to time terminate the employment of agents and revoke such delegations.

(D) Each of said Trustees may resign at any time by notice in writing delivered to the other Trustee. Thereupon, a successor to such Trustee so resigning shall be appointed as follows:

1. If said Leo A. Drey or his successor appointed by him shall die, resign, be or become incompetent to act as Trustee, then Leo A. Drey, in case he is living and competent, may, within sixty (60) days, appoint his own successor, or the successor to his successor who has ceased to be a Trustee; or in case said Leo A. Drey shall have died or shall be incompetent, or within sixty (60) days after his resignation or the resignation of his successor, as the case may be, he shall have failed to appoint a successor, then the other Trustee shall appoint his successor.

2. If said John F. Shanklin, or his successor appointed hereunder shall die, resign, or be or become incompetent to act as co-Trustee, then the other Trustee shall forthwith notify the SOCIETY OF AMERICAN FORESTERS by letter addressed to them at Mills Building, Washington 6, D. C., and deposited in the mails, postage prepaid, and said Society of American Foresters may within sixty days thereafter appoint his successor. If, however, within the sixty days after such letter is deposited as aforesaid, said Society of American Foresters shall not have appointed his successor, then the other Trustee shall appoint his successor.

3. If any other successor Trustee shall die, resign, or be or become incompetent to act as Trustee hereunder, then the other Trustee then acting shall appoint his successor.

The appointment of a successor Trustee shall be by instrument in writing signed and acknowledged in such form as to be admissible to record in the records of Shannon County, Missouri.

(E) If at any time the Trustees shall unanimously agree that the purposes of this trust can no longer be accomplished and the continuance of the trust is no longer useful, then the Trustees shall forthwith, by quit-claim deed, convey said premises to said Leo A. Drey and his heirs. It is provided that this provision shall not be construed as a limitation upon or expression of the possibility of reverter hereinabove expressed.

IN WITNESS WHEREOF, the Parties have hereunto set their hands and seals the day and year first above written.

The Agreement

THIS AGREEMENT, Made and entered into the 1st day of March, 1955, by and between NATIONAL DISTILLERS PRODUCTS CORPORATION, A Virginia corporation, having its office and principal place of business at 99 Park Avenue, New York 16, New York, Party of the First Part, and LEO A. DREY of the County of St. Louis, State of Missouri, and JOHN F. SHANKLIN of the District of Columbia, Trustees under a certain Indenture hereinafter described, and their successors in trust thereunder, Parties of the Second Part;

WITNESSETH, that: WHEREAS, by Indenture of even date herewith the said Leo A. Drey has conveyed to Parties of the Second Part certain lots, tracts or parcels of land lying, being and situate in the County of Shannon, in the State of Missouri, to-wit:

> The SE¼ of the NE¼ of the NE¼ of the NE¼ and the NE¼ of the SE¼ of the NE¼ of the NE¼ of Section 33, Range 3 West, Township 30 North, containing 5 acres, more or less, and the SW¼ of the NW¼ of the NW¼ of the NW¼ and the NW¼ of the SW¼ of the NW¼ of the NW¼ of Section 34 in Range 3 West, Township 30 North, also containing 5 acres, more or less,

upon the limitations, trusts, terms and conditions therein set out, intending by said conveyance to establish a natural area to be maintained by said Trustees, and

WHEREAS, Party of the First Part has the right to cut certain white oak timber now standing upon the premises hereinabove described as set out in deed to said Leo A. Drey from Party of the First Part dated June 1, 1954, and may have other rights with reference to said premises, and WHEREAS, Party of the First Part desires that said premises be used and set aside as a natural area as set out in said Indenture of Trust,

NOW, THEREFORE, in consideration of the premises and the conveyance of said lands to Parties of the Second Part

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by said Leo A. Drey and the establishment and maintenance thereon of a natural area, Party of the First Part hereby covenants and agrees as follows:

1. So long as the lots, tracts or parcels of land hereinabove described shall be held and maintained by Parties of the Second Part and their successors, as a natural area under and pursuant to the terms of the Indenture of even date herewith hereinabove described, Party of the First Part shall not cut on said premises so owned and maintained any white oak timber or any other timber standing thereon, notwithstanding that the same may have been reserved to Party of the First Part under and in accordance with deed between said Leo A. Drey and Party of the First Part dated June 1, 1954.

2. In the event that Parties of the Second Part, or their successors, shall hereafter cease to own and maintain said lands as a natural area, then at any time after they so cease to own and maintain said lands, to the extent permitted under said deed dated June 1, 1954, Party of the First Part shall have the right to cut the white oak timber and any other timber on said premises and this agreement as to the above described lands shall cease to be of any further force or effect. Party of the First Part shall be the sole judge of, and shall determine if and when, said lands cease to be owned and maintained by Parties of the Second Part for the purposes aforesaid. Further, if any part of said premises shall cease to be so owned and maintained, then the rights of Party of the First Part to cut timber on such part shall be restored.

3. This agreement shall be binding upon and insure to the benefit of the parties hereto and their respective heirs, executors, administrators, successors and assigns, but the benefits thereof shall not accrue to any other person, firm or corporation than the Parties of the Second Part and their successors in trust.

4. Nothing herein written is intended or is to be construed as a grant by said Leo A. Drey of any right, title or interest in or upon said premises to Party of the First Part, whose rights in and to said premises are derived entirely under other instruments.

IN WITNESS WHEREOF, The Parties hereto have executed this Indenture as of the date and year first above written.

Washington Section Holds Traditional Meeting at Pinchot Home

The Washington Section of the Society met on the evening of May 26 at the Gifford Pinchot home in Washington. They met in the big library, lined with books, where the Society itself was first organized, and in which its early members a half-century ago used to gather with Gifford Pinchot, enter into lively discussions, and eat baked apples and gingerbread from Mrs. Pinchot's kitchen. Since those early days the meetings grew into a traditional annual affair and were continued at the invitation of Mrs. Pinchot following her husband's death.

Two charter members of the U. S. Forest Service were on hand, Arthur C. Ringland and Lee Kneipp. Both spoke interestingly of their recollections of the first years of the Forest Service and of men and events called to mind by a return to the Pinchot home.

The Honorable John Cooper Wiley, United States Ambassador to the Republic of Panama, a widely traveled career diplomat, spoke of his experiences and observations of man-made deserts throughout the world and of the importance of forests to human welfare. He was introduced by Program Chairman Harris Collingwood.

Results of the election of officers for the coming year were announced. New officers are: Chairman, George S. Kephart, Bureau of Indian Affairs; Vice Chairman, Albert W. Sump, U. S. Forest Service; and Secretary-Treasurer, Gordon R. Heath, U. S. Forest Service.

Retiring Chairman Arnold Hanson presided over the meeting in his always capable and pleasant way.

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatements received in the Society office during the month of May are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of August 1, 1955. Communications from voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section

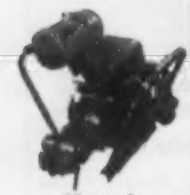
Student Grade

PENNSYLVANIA STATE UNIVERSITY
Megargel, M. W.

Appalachian Section

Student Grade

DUKE UNIVERSITY
French, W. E.



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Junior Grade

Cromer, G. J., 576 Linden Ave., Waynesboro, Va. Reinstatement.
Hudgens, T. A., Flat Rock, N. C. Reinstatement.
Masten, J. C., Forester, Cape Fear Wood Corp., Wadesboro, N. C. Reinstatement.
Peterson, W. A., Project Supt., U.S.D.A., Yanceyville, N. C. Reinstatement.

Member Grade

Elliott, T. R., Dist. Forester, Va. Forest Service, Staunton, Va. (Junior, 1946).
Hanlon, P. J., Forest Supv., U.S.F.S., Harrisonburg, Va. (Junior, 1945).
McAllister, E. A., Forester, Seward Luggage Mfg. Co., Petersburg, Va. (Junior, 1946).
Miller, F. J., Nursery Supt., N. C. State Nursery, Clayton, N. C. Reinstatement.

Central Rocky Mountain Section

COLORADO A & M COLLEGE

Cousineau, W. D.

Central States Section

Student Grade

PURDUE UNIVERSITY

Gamble, R. L. Huston, S. L.

Junior Grade

Hacskaylo, J., Asst. Prof., Ohio State Univ., Wooster, Ohio; W. Va. Univ., B.S.F., 1948.

Associate Grade

Ramsey, O. J., Game Supv., Ohio Div. of Wildlife, Columbus, Ohio; Ohio State, B.S., (Conservation), 1951.

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Brady, L. J. Leonard, G. M.

Junior Grade

Dobyns, W. L., 166 7th St., Sweet Home, Ore. Reinstatement.
Hawks, H. J., Forester, U.S.F.S., Cougar, Wash.; Mont. State, B.S.F., 1951.
Hill, R. D., U.S.F.S., Oakridge, Ore.; Univ. of Mich., B.S.F., 1950.
McCurdy, R. E., U.S.F.S., Oakridge, Ore.; Univ. of Maine, B.S.F., 1949.
Shull, J. T., Crown Zellerbach Corp., Portland, Ore.; Univ. of Wash., M.F., 1926.

Affiliate Grade

Peters, D. L., 901 North 3rd St., Lakeview, Ore. Reinstatement.

Gulf States Section

Student Grade

LOUISIANA POLYTECHNIC INSTITUTE

Woodman, D. H.

Junior Grade

Kemp, A. K., Head, Dept. of Forestry, Stephen F. Austin State College, Nacogdoches, Texas; Univ. of Ga., B.S.F., 1948; Duke, M.F., 1949.

Member Grade

Smith, James L., Dept. of Forestry, Stephen F. Austin State College, Nacogdoches, Texas. (Junior, 1950).

Affiliate Grade

Laughofer, W. A., Area Forester, Corps of Engineers, Batesville, Miss.; Ark. A & M., B.S. (Forestry), 1951.
Townsend, N. W., Dist. For., Southern Pine Lbr. Co., Rusk, Texas; Okla. A & M, B.S. (Forestry), 1951.

Intermountain Section

Student Grade

UTAH STATE AGRICULTURAL COLLEGE

Bones, J. T. Hightree, P. E.
Burkert, K. C. Taylor, L. E.
Gasior, K. V.

Member Grade

Tucker, J. P., Ranger, U.S.F.S., Dubois, Idaho. (Junior, 1948).

Kentucky-Tennessee Section

Junior Grade

Henson, I. C., Power Operations, Kingston Steam Plant, Harriman, Tenn. Reinstatement.

New England Section

Junior Grade

Messeck, W. H., State Forester, State of N. H., Concord, N. H.; Univ. of Maine, B.S.F., 1937.

Affiliate Grade

Grass, A. E., Forester, International Paper Co., Livermore Falls, Maine; Univ. of N. H., B.S., (Forestry), 1954.
Mitchell, C. B., 208 Jolbert St., Berlin, N. H.; Univ. of N. H., B.S., (Forestry), 1952.

New York Section

Student Grade

STATE UNIVERSITY OF NEW YORK

Braman, G. S.

Junior Grade

Smith, W. R., 15th Evac Hosp., A.P.O. 189, New York, N. Y.; State Univ. of N. Y., B.S.F., 1954.

Northern California Section

Junior Grade

Eaton, C. B., Entomologist, U.S.D.A., Orinda, Calif. Reinstatement.
Flynn, J. V., P. O. Box 770, Willows, Calif. Reinstatement.
Voss, R. L., Asst. Ranger, Calif. Div. of Forestry, Porterville, Calif.

Northern Rocky Mountain Section

Student Grade

MONTANA STATE UNIVERSITY

Sedlacek, B. G.

Junior Grade

Van Camp, M. L., For., Tree Farmers, Inc., Missoula, Mont.; Mont. State, B.S.F., 1950.

Ozark Section

Member Grade

Polk, R. B., Asst. Prof., Univ. of Mo., Columbia, Mo.; Univ. of Fla., B.S.F., 1947; Mont. State, M.F., 1949. (Junior, 1948).

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Merritt, R. O.

Junior Grade

Grant, J. F., Forester, U.S.F.S., Olympia, Wash. Reinstatement.
Lewis, J. B., Brazier Const. Co., Seattle, Wash. Reinstatement.
Sandor, J. A., Forester, U.S.F.S., Juneau, Alaska; Wash. State, B.S., (Forestry), 1950. (Affiliate, 1952).

Affiliate Grade

Benham, R. F., Dist. Forest Warden, State Div. of Forestry, Sedro Woolley, Wash.
Osborne, H. W., Field Supv., State of Wash., Sedro Woolley, Wash.

Southeastern Section

Student Grade

UNIVERSITY OF FLORIDA

Allen, J. R.

UNIVERSITY OF GEORGIA

McQuaig, R. L.

Junior Grade

Collins, J. H., Project Forester, State of Ala., Greensboro, Ala.; A.P.I., B.S.F., 1949.
Dykes, O. W., Woodyard Supt., International Paper Co., Eufaula, Ala.; L.P.I., B.S.F., 1953.
Hitchcock, H. C., Foley, Ala. Reinstatement.
Proctor, J. C., Box 4, Woodbine, Ga. Reinstatement.

Southwestern Section

Junior Grade

Gay, L. W., Forester, U.S.F.S., Springerville, Ariz.; Colo. A & M, B.S.F., 1954.

Wisconsin-Michigan Section

Student Grade

MICHIGAN STATE COLLEGE

Riffle, J. W.

Junior Grade

Landino, J. W., Forester, Sterling Pulp & Paper Co., Eau Claire, Wis. Reinstatement.

Affiliate Grade

Autio, W. G., Dist. Supt., Kimberly-Clark of Mich., Inc., Iron River, Mich.
Jarvey, C. C., 1318 Wis. Ave., Gladstone, Mich. Reinstatement.
Lockwood, J. P., Asst. Dist. Forester, Mich. Dept. of Cons., Grayling, Mich.; Mich. College of Mining & Tech., B.S., (Forest Prod.), 1954.

No Section

Affiliate Grade

Merrifield, R. G., F.P.O., New York, N. Y.; Ark. A & M, B.S., (Forestry), 1953.

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When sending these needed copies please be sure to indicate if they are donated—or if credit on membership dues is desired.

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Washington 6, D. C.

Coming Events

Ozark Section Meeting

The summer meeting of the Ozark Section will be held July 22-23 at Tulsa, Okla. The program will feature reclamation of coal strip mines.

Allegheny Section Summer Meeting

The summer meeting of the Allegheny Section has been set for August 5 and 6 at the Fernow Experimental Forest, Elkins, W. Va.

Lake States Forest Improvement Conference

The second Lake States Forest Tree Improvement Conference will be held on August 30-31 at the Nepco Boys & Girls Camp, Wisconsin Rapids, Wis.

Soil Science Society

Annual meeting to be held at University of California, Davis, Calif., August 15-19.

Forestry News

Third Session Asia-Pacific Forestry Commission

Seventeen of the 20 member nations sent 58 representatives to the third session of the Asia-Pacific Forestry Commission at Tokyo, Japan, April 9-21, 1955. Observers attended from the Holy See, the Soviet Union, the United Nations, and the World Meteorological Organization. In an atmosphere reminding one of the United Nations, the meetings were held in the newly built Senkai Kaikan, where headphones were available to everyone and simultaneous translations were made in English, Japanese, and French.

The participants from the United States were:

Joseph S. Harbison, Delegate
Paul W. Bedard, Alternate
G. E. Doverspike, Adviser
Thomas W. McKinley, Adviser
Paul Zehngraff, Adviser

The secretariat progress report covered matters on (a) climatological map as a guide for the introduction of exotics, (b) forest statistics, (c) world planting manual, (d) wood fuel, and (e) shifting cultivation.

Progress reports of most of the member countries in the region were read and commented upon by the respective delegates. These showed a marked progress in planting programs and the development of forest industries and it was noted that research on the utilization of secondary species was being widely pursued. Most of the countries were deeply interested in the problems of forest grazing.

A report on the recommendations of the Fourth World Forestry Congress was read by the secretariat and commented on by the director of forestry, FAO.

Two field trips were arranged by the hosts.

The Commission recommended that the next meeting be held in Bandung, Indonesia early in 1957.

Spruce Budworm Battle to Be Renewed

Spruce budworm is being fought again this summer by aerial spraying on 630,000 acres in northeastern Oregon where the attack is in the epidemic stage. Although its name indicates

(Continued on page 540)

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Financed by a grant from the Rockefeller Foundation, the study was made under the general supervision of a steering committee of the Society of American Foresters and the National Research Council. *Forestry and Related Research in North America* is the result of a reappraisal of the existing structure of forestry and related research programs in North America, and includes recommendations and goals for the next quarter-century.

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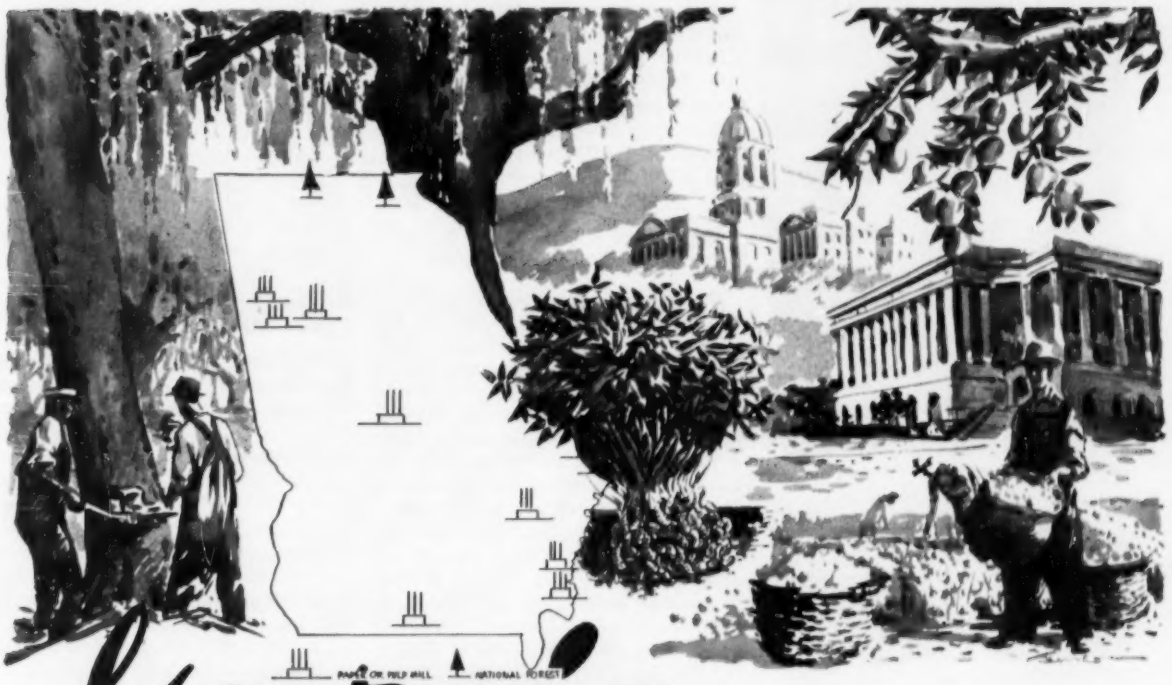

Georgia

Land of Forestry Firsts

Georgia's vast timberlands . . . stretching across 24 million acres and covering two-thirds of the state . . . are the wellspring of a $750 million dollar industry, the playground of millions, and a cornerstone of economy. Georgia's stately pines and majestic hardwoods are her greatest crop. From the Longleaf and Slash pine of the lower and middle coastal plain, northward through the Loblolly and Shortleaf of the Piedmont and north Georgia, and the hardwoods of the higher mountains and along the rich stream bottoms, Georgia has some of the fastest growing timber in the country. Forests provide landowners more income than any other harvest. Private forest ownership predominates in Georgia with the state leading the nation in the number of private forestland owners.

The South's leading producer of pulpwood and lumber, and the naval stores capital of the world, the Empire State of the South is a mecca for forest industry. More than 3500 wood using plants—lumber mills, pulp and paper mills, naval stores distillation plants and a myriad of smaller industries—dot the state's landscape and are a source of employment, commerce and wealth.

Georgia looks to the perpetuation of her valuable forest resource and expansion of her giant forest industry. First in the nation in tree planting and in acres of private and state lands under organized forest protection, the state beckons to enterprise. Public forestry organizations and industry are joined in an epoch effort in forest conservation.

—GEORGIA FORESTRY COMMISSION.—*contribution to this series does not necessarily constitute endorsement of Southern Glo products.*

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that it attacks spruce trees, it is the Douglas-fir and white fir forests of this region where the insect is making its ravages.

Control of the epidemic was begun in 1949. Since then 3¼ million acres have been aerially sprayed with insecticide in Oregon and Washington. This is the most extensive aerial spraying ever done anywhere. So successful has this control been, that so far only 10,000 acres have had to be treated a second time.

This year 502,000 acres of federal timber in the Ochoco, Malheur, and Wallowa-Whitman National Forests and 128,000 acres of intermingled and adjacent private lands will be covered.

This year's program includes the infested areas recommended for treatment by the Northwest Forest Pest Action Committee, composed of public and private foresters and research experts and with E. L. Kolbe, chief forester of the Western Pine Association in Portland as chairman.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

Positions Available

FORESTER WANTED

Experienced graduate forester to take charge of Forestry Program. Applicant must be qualified to make accurate estimates of timber value and to carry on a full Conservation Program. Starting salary $85 per week and increase when merited.

Box H, JOURNAL OF FORESTRY, Mills Building, Washington 6, D. C.

Forest Management Assistant to District Forester

If interested, address communication to **Director, Texas Forest Service, College Station, Texas.**

Positions Wanted

Forester, B.S.F. 1951, University of Florida; single, 26 years. Practically no experience, plenty of initiative; desire employment with training opportunity and advancement, primary objectives; salary currently of minor importance. Air force experience includes 2½ years in supervisory capacity in Control Tower; radio broadcasting experience.

Box F, Journal of Forestry, Mills Building, Washington 6, D.C.

Forester 27, B.S. 1952, Yale M.F. 1954, married. 3 years experience eastern Canadian pulpwood operations. Interest management, silviculture, or extension forestry. Desires to locate in Northeast.

Box G, Journal of Forestry, Mills Building, Washington 6, D. C.

Ohio Forestry Association's Watershed Conservation Plan

An action program to insure Ohio's future water supply is presented in an 8-part Watershed Conservation Plan developed by the Ohio Forestry Association.

According to William Laybourne, executive director, the reports embody a year's research on the part of six task groups. The 141 pages of text are supplemented by 61 charts and tables detailing the statistics of the state's 14 major watersheds. The combined reports are available at a price of $10 from the Association headquarters, Southern Hotel, Columbus 15, Ohio.

The committee was headed by Elliott B. McConnell, vice president of the Standard Oil Company (Ohio). Serving as coordinator of research and editor of the reports was Sherman L. Frost of the OFA staff.

Findings of the committee are summarized in five initial recommendations:

1. Formation of citizens' committees in each watershed to consider local needs and potentialities, to adapt the overall policy to their own communities, and to spearhead programs of education.

2. Cooperation among state and federal agencies to complete an inventory of water resources, determining within each watershed present water availability, water use, and future water needs.

3. Reactivation and broadening of conservancy districts as means of developing, within the watershed, integrated water supply, flood control and drainage systems, and methods of soil and forest management.

4. Scrutiny by a legislative committee of the various public agencies responsible for conservation activities, to determine the adequacy of current programs in relation to the proposed watershed development.

5. Evaluation of present water-use laws to provide for the equitable distribution of available supplies among competing interests.

NOTICE TO INDUSTRY

Personnel Placement

A service for industrial firms, foresters, and timbermen—to find the best qualified man for the job. List your openings in forestry and allied fields with me. I can supply information on qualified men. Inquiries handled confidentially.

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Keith Cranston, *Forestry Consultant*
LELAND, MISSISSIPPI

Soil Science Society to Hold Annual Meeting

The Forest and Range Division of the Soil Science Society of America is planning its annual meeting at the University of California at Davis, Calif. August 15-19.

In addition, a field trip, sponsored jointly by the S.S.S. and the Douglas Fir Forest Soils Commission, will follow the meetings and promises to be of interest and value to any foresters and range managers who might wish to attend.

Anyone interested in participating in the field trip may contact C. T. Youngberg, Dept. of Soils, Oregon State College, Corvallis, or during the meetings in Davis.

Government

E. P. Furlow Joins Tariff Commission

Edward P. Furlow, 1949 Purdue forestry graduate, has recently joined the staff of the Lumber and Paper Division of the U. S. Tariff Commission, in Washington, D. C. Prior to this Furlow has been with the Virginia Forest Service for a period of two years and with the Fordom Forest Products Company on a West Africa assignment.

Floyd Iverson Transfers

Floyd Iverson, chief of Range and Wildlife Management, Northern Region, U. S. Forest Service, has transferred to Ogden, Utah. Mr. Iverson assumed his new duties as chief of the Range and Wildlife Management Division of the Intermountain Region on July 1st.

Iverson has been assistant regional forester at Missoula since 1952, when he transferred from the regional office of the Forest Service at Portland, Oregon.

Wind River Federal Unit Hearing Denied

Following full consideration of the application, the communities of Stevenson, Carson, and North Bonneville, Wash., have been advised by Regional Forester J. Herbert Stone that their proposal for establishment of a federal sustained yield unit in the Gifford Pinchot National Forest does not qualify sufficiently to justify a public hearing.

Under provision of the Act of March 29, 1944, the Secretary of Agriculture is granted discretionary authority to establish federal units.

Representatives of the three communities have been working on the proposal for several years, according to Stone, and had requested that the unit be established to include timber harvested in the Wind River working circle of the forest.

The Forest Service had been actively processing the federal unit application for several months, reviewing the qualifications of the proposed unit against criteria established for such units. Several meetings were held with representatives of the proponent communities as well as with representatives of communities which were opposed to the establishment of the Wind River unit. Stone advised that the proponents had not demonstrated sufficiently that the Wind River federal unit is necessary in order to maintain the economic stability of the towns which would have been included in the proposal.

According to Stone, normal Forest Service timber sale procedure of competitive bidding is meeting the needs of these communities.

Lake States Station Adds Dr. Nienstaedt to Forest Genetics Staff

Dr. Hans Nienstaedt, specialist in forest tree genetics, has been appointed as a staff member of the Lake States Forest Experiment Station in St. Paul to undertake research in forest tree improvement work in that region, according to M. B. Dickerman, director of the Station.

Dr. Nienstaedt, a native of Copenhagen, Denmark, was educated at the Royal College of Agriculture. Later becoming a citizen of the United States, he obtained a doctorate degree at Yale University. Since then he has been doing forest research work relating to the chestnut and hemlock breeding programs at the Connecticut Agricultural Experiment Station in New Haven. His efforts have been directed toward developing a hybrid chestnut that is resistant to attacks by the fungus; and he has published several papers on the subject.

N. S. Rogers Memorial Forest

The N. S. Rogers Memorial Forest, named in honor of the late Nelson S. Rogers, state forester of Oregon during 1940-1949, was recently dedicated as a state forest.

The forest, a 3,700-acre tract, is the site of some of the first experiments in the rehabilitation of the great Tillamook burn. Mr. Rogers was instrumental in modernizing Oregon's forest code, and in obtaining legislation for seed sources and reforestation of private land.

J. R. Castles, P. E. Neff Promoted

The transfer of John R. Castles from the position of chief logging engineer, Division of Timber Management, in the regional office of the Forest Service at Missoula, Montana, to the position of chief of the Section of Timber Management Plans has been announced by Regional Forester P. D. Hanson.

Hanson also announced the promotion of Paul E. Neff from the position of assistant logging engineer to chief logging engineer in the Division of Timber Management.

Castles graduated from the School of Forestry, Montana State University in 1938, and in 1950 received a master degree from the University of California. He served in the European Theater during World War II, returning to the Forest Service in 1946.

Neff also graduated from the School of Forestry, Montana State University. He started work in the Forest Service in 1937 and served in the Pacific Theater during World War II.

Industrial

William H. Cummings Heads Weyerhaeuser Research Unit

William H. Cummings, who for the past academic year has had a teaching assignment at the School of Natural Resources, University of Michigan, is

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SOCIETY OF AMERICAN FORESTERS

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now supervisor of Weyerhaeuser Timber Company's Forestry Research Laboratory at Centralia, Wash.

During 1953 and early 1954, Mr. Cummings was project forester for the Society of American Foresters' research project. With Dr. Frank H. Kaufert, he is co-author of the book *Forestry and Related Research in North America*, recently published by the Society.

A.P.A. Research Fellowship Offered

A research fellowship sponsored by the American Pulpwood Association at the State University of New York College of Forestry, Syracuse, N. Y.; at $2,400 on a twelve-month basis is currently open, according to an announcement by Dr. Edwin C. Jahn, associate dean for physical sciences and research.

The graduate fellow would work on the development of a Directory of Research in Growing and Harvesting Pulpwood. This directory, according to Mr. W. S. Bromley, executive secretary of the American Pulpwood Association, will serve the pulpwood industry and public agencies as a reference guide to the progress of experimental work throughout the country and as a more effective medium of coordination of efforts in this field.

Preference will be given applicants who have had industrial experience in pulpwood or forestry work, and who wish to work toward an advanced degree in forest research management. The graduate fellow will work under the direction of Dr. Paul Graves, who teaches forest management and administration with particular interest in industrial forestry activities.

Persons who wish to apply for this fellowship should promptly address the Graduate Committee, State University of New York College of Forestry, Syracuse 10, New York.

Great Northern Puts Chemigroundwood Process in Operation

The chemigroundwood process for pulping hardwoods has been put into operation by the Great Northern Paper Company, East Millinocket, Maine. The new $43,000,000 plant produces 200 tons of pulp daily and is expected to step up to 400 tons daily within a year.

The chemigroundwood process was developed at the State University of New York College of Forestry in a research program supported by the Empire State Paper Research Associates, Inc.—20 pulp and paper companies in the U. S., Canada, and Europe.

N.L.M.A. Awards Four Scholarships

Four forestry school students from Michigan, Minnesota, Montana, and Oregon have been awarded $500 scholarships by the National Lumber Manufacturers Association.

The winners, chosen from students nominated by 11 of the nation's leading forestry schools, are: Henry Albert Huber, University of Michigan; Donald Charles Markstrom, University of Minnesota; Kennedy Alfred Wanner, Montana State University; and Thomas Joseph Patterson, Oregon State College.

Each scholarship winner will receive a cash award of $500 and ten weeks' training in wood technology and utilization this summer at the Washington, D. C., laboratory of the Timber

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FOREST SCIENCE

A Quarterly Journal of Forestry Research

You are invited to become a charter subscriber to FOREST SCIENCE, the new quarterly journal of forestry research which made its appearance in March 1955. Subscription price $6—foreign postage 50 cents, Canadian 25 cents.

FOREST SCIENCE is being published by the Society of American Foresters with the cooperation of forest research and educational organizations generally. It is designed to bring together in a single journal of international circulation papers of interest to research workers, teachers, and administrators and will supplement, rather than compete with, the *Journal of Forestry*.

Subscribe now to FOREST SCIENCE
SOCIETY OF AMERICAN FORESTERS
Mills Building, Washington 6, D. C.

Engineering Co., research affiliate of N.L.M.A. Each winner also will be paid travel expenses to and from Washington.

The N.L.M.A. scholarship program, now in its sixth year, is designed to encourage a greater number of technically-minded forestry students to prepare for permanent employment in the private wood industries.

St. Regis Paper Company Announces Personnel Changes

St. Regis Paper Company announces that H. Dyer Phillips is appointed resident woodlands manager at Deferiet, New York. He will have charge of the woodlands operations in New York, Vermont, and New Hampshire.

Phillips is a graduate of the College of Forestry, State University of New New York. He joined St. Regis in 1941 and has served as divisional forester of the Woodlands Division since 1948.

George D. Gates has been transferred from the Adirondack Woodlands Division to the New Hampshire-Vermont Division, where he will serve as forester.

Francis M. LaDue and Stanton G. V. Hart have been assigned to the Woodlands Division of North Western Pulp & Power, Ltd., at Hinton, Alberta.

They will form part of the Alberta Woodlands Division, which is under the direction of Gordon D. McNab, resident woodlands manager.

Both men are graduates of the School of Natural Resources, University of Michigan. LaDue joined the St. Regis Woodlands Division at Deferiet, New York, in 1952 as forester in the Adirondack Woodlands Division. Mr. Hart also joined St. Regis in 1952 and served with the New Hampshire-Vermont Woodlands Division.

Private

Richard W. Abbott Buys Tree Nursery in Tennessee

Richard W. Abbott, formerly assistant extension forester of Wisconsin, has purchased a nursery and landscaping business at Morristown, Tenn.

Mr. Abbott recently returned from a technical assistant assignment in Libya where he helped set up a reforestation program for arid lands.

Education

Cooperative Wildlife Research Units Have 20th Birthday

Two decades of accomplishment in the wildlife research and management field mark the 20th anniversary of the Cooperative Wildlife Research Unit program that had its beginning in 1935 at Iowa State College in Ames. Similar units presently are located at land grant colleges and universities in 16 states and in Alaska.

The objectives of the unit program are to train graduate students in the field of wildlife research and management, study wildlife resources problems in the regions where the units are headquartered, promote public understanding of the need and application of accepted wildlife management principles, and to assist the various state and federal conservation agencies.

More than 2,200 trained wildlife students have graduated from the units, and many of them now hold key positions in this field of natural resources endeavor. Many of the wildlife management techniques and principles that are being used by the state and federal conservation agencies stem from findings of studies that were conducted under these cooperative programs.

Units are now located in Alabama, Alaska, Arizona, Colorado, Idaho, Iowa, Maine, Massachusetts, Missouri, Montana, Ohio, Oklahoma, Oregon, Pennsylvania, Texas, Utah, and Virginia.

A. J. Nash Joins Missouri Faculty

Andrew J. Nash, Ottawa, Ontario, Canada, has been named assistant professor of forestry at the University of Missouri, effective July 1.

Since 1946, Nash has been a forest engineer for the Forest Research Division of the Canada Department of Northern Affairs and National Resources located in Ottawa.

He did his undergraduate college work at the University of British Columbia, Vancouver, Canada, receiving his BA and BS degrees there. In 1952, he received his MS degree in

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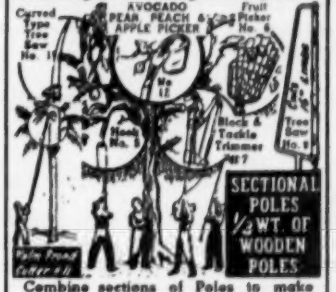
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forestry at the State University of New York.

At the University of Missouri, he will replace Paul Y. Burns who recently resigned from the forestry department to become director of the School of Forestry at Louisiana State University, Baton Rouge.

Midwest Forestry Club Conclave Held

The second annual Midwest Forestry Club Conclave was held May 7th at the Cloquet Experimental Forest, Cloquet, Minnesota. Schools represented at the Conclave included Purdue University, Iowa State College, University of Michigan, Michigan State College, and the University of Minnesota, the host school.

The conferees spent the morning of May 7th touring the Experimental Forest. The afternoon featured contests in log sawing, chopping, compass traverse, log rolling, tree estimation, match splitting, and tobacco spitting. In these events Purdue received high team score and the Conclave Award Plaque. Purdue's winning team consisted of Charles McCuddy, Bob Butler, Marcus Hmurovich, Bob Dzur, Joe Bruggenschmidt, and Randy Herberg, all student members in the Society of American Foresters. Good food, speakers, songs, and fellowship, about a campfire rounded out the day.

The approximately 75 forestry students present at the Conclave were unanimous in agreeing that the meeting was a grand success. The Third Annual Conclave to be held May, 1956 will be hosted by Iowa State College at Ames, Iowa.

Pack Foundation Prize Awarded

The Charles Lathrop Pack Foundation Forestry Prize for 1954-55 has been awarded to Miss Anne La Bastille, a senior in the New York State College of Agriculture, Cornell University. Miss La Bastille is majoring in wildlife management, and has written from first hand experience in the Florida swamp land an essay entitled "The Saving of Cork Screw Sanctuary." The award is made annually to the winner of the competition involving essays on some subject related to conservation treated from the public point of view for the public benefit. The judges for the competition were Professors Emeritus Bristow Adams and Cedric H. Guise and Professor Lawrence S. Hamilton. The amount of the award is $40.

Equipment

Back-Fire Drip Torches

The Panama Pyramid drip torch with preheater provides a means for preheating the fuel almost to the flash point before it comes in contact with the flame. The fuel comes down the nozzle, through the safety loop cold; is preheated in the burner; and discharged onto the burning wick and instantly ignited. It will "carry" the flame onto the ground. Constructed to withstand rough going to which backfire torches generally are subjected.

Get catalogue and prices on all forestry equipment from Forestry Suppliers, P. O. Box 8096, Jackson 4, Miss.

Hardwoods Control Methods Exhibited

Thompson Chemicals Corporation held its 2nd annual field day for pine forest and wood pulp industries at its Brush Research Station No. 2 located at Lead Hill, just north of Harrison, Arkansas, on June 2nd.

Described were the latest and most successful chemical brush killing techniques which have been developed at the Thompson Station. According to the Thompson staff improved broad spectrum selective herbicides, superior wetting and creeping agents, and advanced application methods have made it possible to obtain an almost complete kill of all deciduous woody species, both brush and tree, without damage to desirable conifers. Excellent results have been obtained during the growing season by foliage spraying employing plane, truck, tractor, or knapsack and, at all seasons of the year, by basal and stump application.

The Thompson Research Station, now in its fifth year of operation, has classified the results which may be anticipated from many types of application, dilutions, and herbicidal compounds. Although the company manufactures only herbicides, and not equipment, its field staff has developed several types of spray equipment for which plans are readily available, without cost. An airstrip is available at the station for those who fly in.

Further information is available from the Thompson Chemicals Corporation, 3028 Locust Street, St. Louis 3, Mo.

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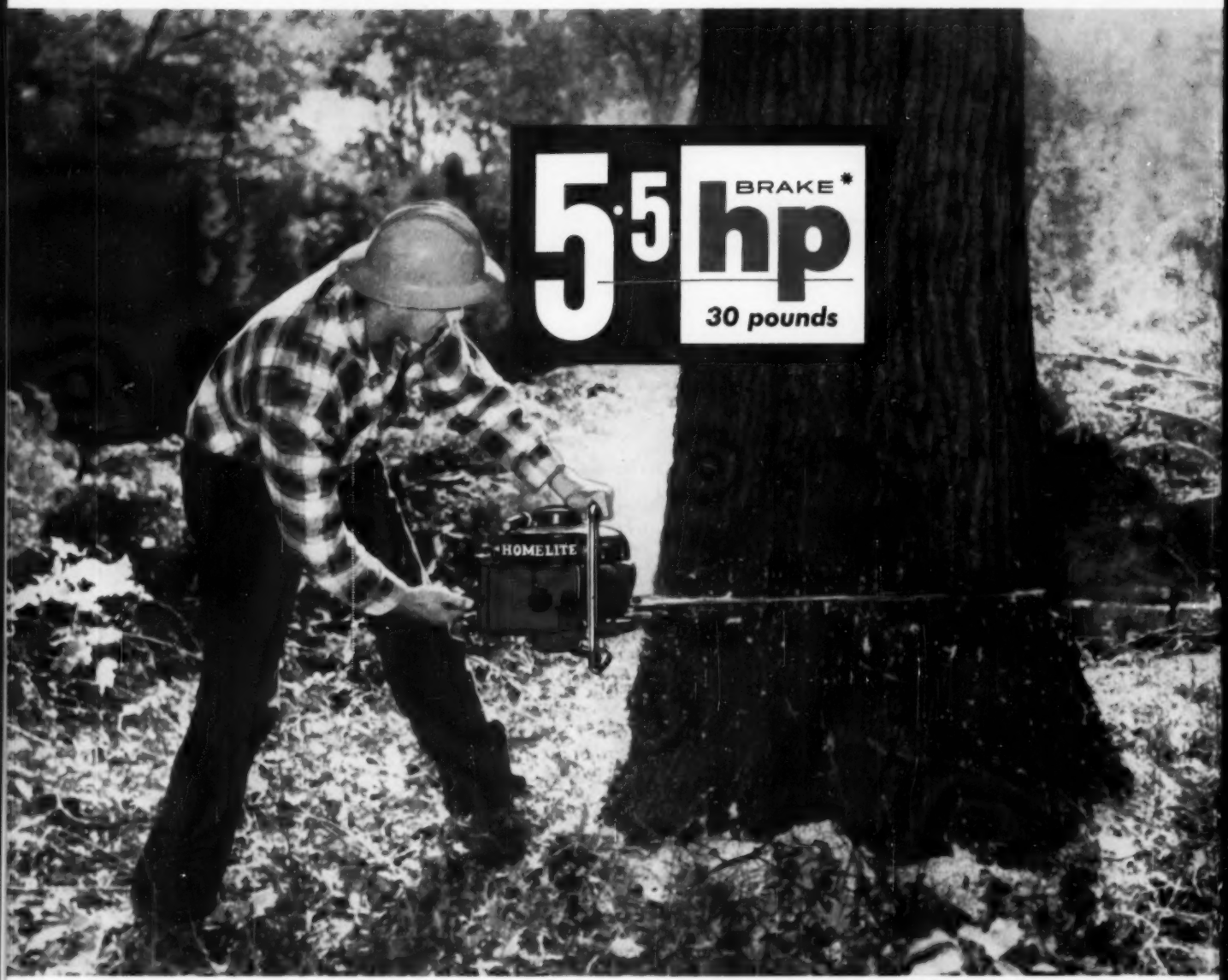

*Actual dynamometer rated horsepower

Here's the fastest cutting, most powerful, one man chain saw ever developed. The Homelite Model 5-30 fells tree after tree from morning to night . . . brings down the big ones five feet or more in diameter . . . rips through 20 inch trees in 20 seconds. It's compact, it's dependable, it takes much of the work out of day-long cutting. Ask your Homelite Representative for a demonstration and see for yourself how the Model 5-30 reduces maintenance to a minimum, eliminates costly down time and helps you keep your production schedules on time.

PERFORMANCE · DEPENDABILITY · SERVICE

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